NUCLEAR SCIENCE ABSTRACTS

Volume 31 Number 6

Abstracts 13594-15900

March 31, 1975

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NOTICE

A title page for Volume 31, Numbers 1–6, is included at the back of this issue for use in binding those issues.

CORRECTIONS

NSA Vol. 28, No. 4, Abst. 8460, line 4 should read: (Inst. of Biophysics, Kiev). Vop. Onkol.; 18: No. 10, 87(1972).

NSA Vol. 30, No. 10, Abst. 27058, line 10 should read: reviewed. The 30-year dose, calculated in terms of millions of man-rems, is

NSA Vol. 30, No. 12, Abst. 33553, line 1 should read: (N-74-18339) CHARGED PARTICLE MOTIONS IN A

NSA Vol. 30, No. 12, Abst. 34453, line 1 should read: (UCRL-51600) METHYL ALCOHOL PRODUCTION

NSA Vol. 31, No. 1, Abst. 25, line 3 should read: CETYLTRIMETHYL-AMMONIUM BASES. Kirillov, A. I.; Shaulina, L. P.;

NSA Vol. 31, No. 2, Abst. 2746, line 1 should read: (UCID-15644-74-2) GENERAL CHEMISTRY DIVISION

NSA Vol. 31, No. 2, Abst. 4917, line 3 should read: (Lyon-1 Univ., 69-Villeurbanne (France). Inst. de Physique Nucleaire). Jul 1973. 120p. (In

NSA Vol. 31, No. 3, Abst. 5952, line 1 should read: (UCRL-51671) COMPARISON OF INITIAL CONDITIONS

Volume 31, Number 6, March 31, 1975

NUCLEAR SCIENCE ABSTRACTS

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Nuclear Science Abstracts provides the only comprehensive abstracting and indexing coverage of the international nuclear science literature. It covers scientific and technical reports of the U. S. Energy Research and Development Administration and its contractors, other U. S. Government agencies, other governments, universities, and industrial and research organizations. In addition, books, conference proceedings, individual conference papers, patents, and journal literature on a worldwide basis are abstracted and indexed. Each issue of *Nuclear Science Abstracts* includes four indexes: subject, personal author, corporate author, and report number.

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REACTOR CORES/INSPECTION
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23214 (HEDL-TME-74-16) ANALYSIS OF TEMPERATURE PROFILES IN TRANSIENTLY HEATED UO_2 USING MOLYBDENUM INCLUSIONS. Wilmot, E. L. **(Hanford Engineering Development Lab., Richland, Wash. (USA)).** [nd]. Contract AT(45-1)-2170. 23p. AT.

is indexed as:

HANFORD ENGINEERING DEVELOPMENT LAB., RICHLAND, WASH. (USA)
Analysis of temperature profiles in transiently heated UO_2 using molybdenum inclusions, 30:23214 (HEDL-TME-74-16)
HEDL quarterly technical report, January--March 1974. Volume I. Materials technology, 30:21815 (HEDL-TME-74-1(Vol.1))
Modeling of the post-irradiation fuel-cladding gap in mixed-oxide fuels, 30:23103 (HEDL-TME-74-19)
Preliminary data report: post-irradiation examination of fuel pins PNL-10-23 and PNL-10-63, 30:23149 (HEDL-TME-74-23)
Prototype applications loop two years of operation, 30:20928 (HEDL-TME-74-24)

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Information on the availability of the published literature and unpublished conference papers abstracted in *Nuclear Science Abstracts* can be obtained from the USERDA Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

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NUCLEAR SCIENCE ABSTRACTS

CHEMISTRY

13594 168th NATIONAL MEETING OF THE AMERICAN CHEMICAL SOCIETY, ATLANTIC CITY, NEW JERSEY, SEPTEMBER 8–13, 1974. Abstracts of Papers. Washington, DC; American Chemical Society (1974). vp. (CONF-740955-(Abst.)). $9.00.

Analytical and Separations Chemistry

Refer also to abstracts 14430 and 14707.

13595 DEVELOPMENT OF RADIOANALYTICAL METHODS IN HUNGARY. Banyai, E. (Budapesti Muszaki Egyetem (Hungary). Altalanos es Analitikai Tanszek). Kem. Kozlem.; 38: 382-396(1972). (In Hungarian).

169 refs.

New methods of neutron activation analysis developed in Hungary for the determination of the trace contaminations of semiconductor materials (Si, Ge, GaAs), of pure metals (Cu, Al, Ni, W etc.) and of some chemical products (petroleum products, medicines, chemicals) are described. The analysis of biological and medicinal samples and the determination of main and trace constituents of rocks and ores may also be carried out by this method. A brief survey is given of the development of the methods of paper-chromatography, solvent extraction, heterogeneous isotopic exchange, and paper-electrophoresis. The new results achieved in the development of the measuring technique of beta-radiation of low energy, the methods of oscillometry, x-ray spectroscopy, analysis with radio-reagents, and the measurement of absorption and reflection of radiation are described. (INIS)

13596 SECOND AUSTRALIAN SYMPOSIUM ON ANALYTICAL CHEMISTRY, KENSINGTON, AUSTRALIA, MAY 14–18, 1973. Programme and Abstracts. Parkville, Australia; Royal Australian Chemical Institute (1973). vp. (CONF-7305108-(Absts.)).

Activation and Nuclear Reaction Procedures

Refer also to abstracts 14179 and 15661.

13597 (CONF-741221-4) REPLACEMENT OF CHEMISTRY IN ISOTOPE CALIBRATION, ACTIVATION ANALYSIS, AND FUEL ELEMENT ANALYSIS BY INSTRUMENTAL γ-RAY SPECTROMETRY. Emery, J. F.; Dyer, F. F. (Oak Ridge National Lab., Tenn. (USA)). 1974. 12p. Dep. NTIS $4.00.

From 3rd interamerican meeting on radiochemistry; Sao Paulo, Brazil (2 Dec 1974).

A γ spectrometer system consisting of a high resolution Ge(Li) γ analyzer and a minicomputer interfaced to a multichannel analyzer is being used for radioisotope calibration, multielement determinations in a variety of materials, and fuel element scanning by absolute neutron activation. MONSTR, written for complete data reduction of these spectra, has three classes of routines: system calibration and parameters, data analysis and processing, and input/output. Some typical results obtained with the system are tabulated. (JSR)

13598 NONDESTRUCTIVE MULTIELEMENT PHOTON ACTIVATION ANALYSIS OF ENVIRONMENTAL MATERIALS. Kato, T. (Tohoku Univ., Sendai); Sato, N. Kakuriken Kenkyu Hokoku; 7: No. 1, 164-178(Jun 1974).

A nondestructive photon activation procedure with 30-MeV bremsstrahlung followed by high-resolution gamma-spectrometry was designed for the multielement analysis of environmental materials. Precision and accuracy of the method were tested by analyzing the NBS standard reference material, Fly Ash, and abundance data for 17 elements were obtained. The agreement of the results with literature data, where comparable, is excellent. The method was then applied to the determination of up to 21 elements in atmospheric particulate matter collected on a Millipore filter. Those are As, Ca, Ce, Cl, Co, Cr, Fe, I, K, Mg, Mn, Na, Ni, Pb, Rb, Sb, Sr, Ti, Y, Zn and Zr. (auth)

13599 ACTIVATION ANALYSIS AND APPLICATIONS TO ENVIRONMENTAL RESEARCH. Filby, R. H.; Shah, K. R. (Washington State Univ., Pullman). Toxicol. Environ. Chem. Rev.; 2: No. 1, 1-44(1974).

The principles of activation analysis as a method of trace element determination are discussed and applications of neutron activation analysis to environmental problems reviewed. Thermal and fast neutron activation analyses using nuclear reactors, accelerators and ^{252}Cf sources are considered and recent developments in γ spectrometry such as, Ge(Li) detectors, anticoincidence shielded Ge(Li) detectors and multidimensional NaI(Tl) spectrometers are outlined. The advantages and disadvantages and sources of error in neutron activation analysis for trace element determination are discussed with emphasis on problems associated with the analysis of environmental materials. Applications of neutron activation analysis to air pollution studies, marine and fresh-water trace element measurements, and to the problem of mercury pollution are reviewed. (170 references) (auth)

13600 BERYLLIUM CONTENT OF STANDARD ROCKS DETERMINED BY NONDESTRUCTIVE PHOTON ACTIVATION. Quandt, U.; Herr, W. (Univ., Cologne). Radiochem. Radioanal. Lett.; 20: No. 1, 65-72(18 Dec 1974).

A series of U. S. Geological Survey standard rocks (AGV-1, BCR-1, DTS-1, G-2, GSP-1 and PCC-1) as well as standard rocks distributed by the DDR Central Geological Institute of the Academy of Sciences, Berlin, (BM, TB, GM, KH, TS and FK) were analyzed "non-destructively" for Be content by photoneutron counting. Physical and nuclear interferences were considered. By appropriate electronics a high instrumental reproducibility (>99%) and a precision of the analysis (<1%) were achieved. The study shows that the former "recommended values" (Flanagan) for Be have to be corrected in some cases by more than 50%. (auth)

13601 BERYLLIUM ABUNDANCE OF METEORITES DETERMINED BY "NON-DESTRUCTIVE" PHOTON ACTIVATION. Quandt, U.; Herr, W. (Koeln Univ. (F.R. Germany). Inst. fuer Kernchemie). Earth Planet. Sci. Lett.; 24: No. 1, 53-58(Nov 1974).

The beryllium content of 73 stony and 4 iron meteorites was determined nondestructively by a newly developed sensitive low-level counting device. A fairly widespread beryllium content of stones ranging from 13 to 386 ppB was found. As expected from the lithophilic character of Be the 4 siderites contained < 8 ppB only. The resulting average chondritic abundance of 74 ppB Be is more than one order magnitude lower than the cosmic abundance value adopted earlier by H. E. Suess and H. C. Urey (1956), but still about a factor of 2 higher than the value chosen by A. G. W. Cameron (1968). Ten to 15 g samples were taken in order to guarantee a rather good "mean." For

comparison the Be content of the U. S. Geological Survey basalt BCR-1 was determined in the same way to be 1.390 ± 0.006 ppM Be. (auth)

13602 DETERMINATION OF THE MERCURY CONTENT IN NATURAL WATERS BY ACTIVATION ANALYSIS. Toth, G. Period. Polytech. Chem. Eng.; 18: No. 1, 3-7(1974).

A method was developed for determining mercury traces in natural waters primarily for solving tasks where, owing to the extremely low mercury content of the samples, very large volumes must be concentrated before activation. The described procedure ensures such concentration from samples of only several 10 liters volume. It is based on the spontaneous deposition of mercury on palladium black, activation of the palladium black together with the mercury deposited on it in a nuclear reactor, and separation of the radioactive mercury isotopes from palladium black and other isotopes formed during activation by isotope exchange. (Hung. Tech Abstr.)

13603 THE QUANTITATIVE DETERMINATION OF PALLADIUM, IRIDIUM–PLATINUM AND GOLD IN A STANDARD PLATINUM-BEARING ORE. le Roux, H. L.; Beukes, P. J. L.; Turkstra, J.; de Wet, W. J. (Atomic Energy Board, Pelindaba, Pretoria (South Africa). Chemistry Div.). J. S. Afr. Chem. Inst.; 27: 28-35(1974).

Micro quantities of the most important noble metals in a standard platinum ore were determined by means of reactor activation analysis and high-resolution γ spectrometry. Chemical separations were used to improve the accuracy of the determination of platinum and palladium. Iridium and gold were determined instrumentally, while gold was also determined destructively, simultaneously with platinum. (INIS)

13604 A NEUTRON-ACTIVATION ANALYSIS OF LINDAN AND DDT RESIDUAL CONCENTRATIONS IN SOIL SAMPLES. Gunchev, Kh.; Dimchev, T. Pochvozn. Agrokhim.; 3: No. 1, 77-86(1973). (In Bulgarian).

Neutron-activation analysis of chlorine-containing pesticide residues in soil samples was performed, after an organic preextraction and washing of the extracts. A procedure was developed and formulas were deduced to measure the concentrations by the use of control, standard, and zero samples in the case of measurements by two peaks of total absorption of ^{38}Cl, corresponding to an energy of 2.16 MeV. The samples studied were taken from the experimental plots planted with tobacco, treated with lindan. The fields were treated with DDT. Samples were also studied from areas not treated with chlorine-containing pesticides. The results obtained were of the same order and pointed to a general contamination. The similarity in the results was established with the aid of a double and repeated analysis. The concentrations measured were of the 10^{-5} g/g of soil order. (auth)

13605 NEUTRON AND THE DETECTIVE. Gangadharan, S. (Bhabha Atomic Research Centre, Bombay (India). Analytical Chemistry Div.). Sci. Today (Bombay); 8: No. 9, 54-57(Mar 1974).

Hair is one of the most common and potentially important pieces of evidence in crime investigation, and it has been extensively investigated by neutron activation analysis (NAA) for trace element characterization. The distribution of these elements in hair is influenced by age, sex, food habits, occupation, living environment, and health. The distribution of trace elements in the hair of the Western population has been much studied by NAA. The sex of a person can be identified from trace element data of his/her hair. Certain elements like copper, manganese, iron, and nickel influence the color of hair: grey hair has a large amount of nickel, while dark brown hair has a high amount of copper. Hair can also be used as a diary of past events by studying the sectional variations. It is pointed out that the role of NAA in forensic science, however, need not be limited to blatantly criminal acts; it can be used in all analytical investigations pertaining to law, be it violation of food and drug laws, or public health, and safety standards or pollution of the environment. (INIS)

Chemical and Spectral Procedures

Refer also to abstract 14115.

13606 (ARH-3057) SPECTROCHEMICAL ANALYSIS OF METALLIC IMPURITIES IN PLUTONIUM DIOXIDE. Homi, C. S. (Centre National de la Recherche Scientifique, 67 — Strasbourg (France). Dept. de Chimie Nucleaire). Mar 1974. Contract AT(45-1)-2130. 43p. Dep. NTIS $5.25.

The development history of the Atlantic Richfield Hanford Company spectrochemical method for impurity analysis of reactor grade plutonium dioxide is discussed. Topics included are: (1) carrier type and amount; (2) electrode design; (3) sample arcing and arcing environment; and (4) standards and analytical curves. (auth)

13607 (BNWL-SA-5174) ANALYTICAL CHEMISTRY OF NATURAL WATERS. Robertson, D. E. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 30 Sep 1974. Contract AT(45-1)-1830. 51p. (CONF-741023-6). Dep. NTIS $5.75.

From 7th materials research symposium; Gaithersburg, Maryland, USA (7 Oct 1974).

In order to illustrate the parameters which must be considered and evaluated to insure accurate and precise measurements of trace elements in natural waters, the results of Hg determinations in Atlantic Ocean seawater samples are discussed. The Hg analysis was made by the uv absorption of vaporized Hg atoms. Uncertainties in the measurement led to an evaluation of the sampling techniques, storage methods, consistent and known yields of chemical manipulations, consistent procedural blanks, verification by another analytical method, analysis of standard reference material, establishing analytical precision, and chemical and instrumental interferences. (JSR)

13608 (COO-2130-119, pp 351-376) ANALYTICAL USE OF ION-INDUCED X RAYS. Saris, F. 1973.

In heavy ion lecture series. Volume I.

The production of x rays by heavy-ion bombardment and their use as an analytical tool are discussed. The high efficiency and sensitivity of the ion-induced x-ray technique are ideal for trace element analysis of air, water, and biological samples, as well as in many areas of physics. Channeling can be used to do detailed solid state studies. On the other hand, much research is still required on the background yields observed with these x-ray spectra. (22 figures) (RWR)

13609 (ORNL-NSF-EATC-8) RAPID ^{15}N ISOTOPIC-RATIO AND TOTAL NITROGEN ANALYTICAL SYSTEM FOR ENVIRONMENTAL SAMPLES. Carter, J. A.; Walton, J. R.; Walker, R. L.; Matthews, D. R. (Oak Ridge National Lab., Tenn. (USA)). Jan 1975. Contract W-7405-eng-26. 22p. Dep. NTIS $4.25.

An analytical system for measuring total nitrogen and its isotopic abundance in a variety of environmental samples has been developed. A reductive pyrolysis system and a direction focusing 6-inch gas mass spectrometer were combined into the analytical system. In the reductive part of the system, nitrogen species are converted to ammonia with an atmosphere of hydrogen in the presence of a heated nickel catalyst. Five percent of the gas stream is split away for measuring total nitrogen by a conductivity detector. The ammonia is removed from the gas stream employing a cold finger reaction vessel. The hydrogen-free ammonia is decomposed thermally to nitrogen and hydrogen at 1000°C employing a hot rhenium filament. The N_2 produced from the decomposition is used for measuring the abundance of masses 28 and 29 by mass spectrometry. From this ratio, the ^{15}N atom fraction is calculated. Standard samples of N_2, ammonia, orchard leaves, and urea have been successfully analyzed to determine isotopic compositions. Samples containing as little as 20 μg of total nitrogen can be analyzed by this system. By the addition of multi-reaction vessels, three samples may be completed per hour. (auth)

13610 (RFP-2152) HISTORY, USES, OCCURRENCES, ANALYTICAL CHEMISTRY, AND BIOCHEMISTRY OF BERYLLIUM. A Review. Hurlbut, J. A. (Dow Chemical U. S. A., Golden, Colo. Rocky Flats Div.). 16 Dec 1974. Contract AT(29-1)-1106. 26p. Dep. NTIS $4.00.

A literature search in Chemical Abstracts dated 1947 through July 1973 and concerning beryllium and beryllium oxide was performed in an attempt to uncover a beryllium exposure bioassay. The history, use, occurrence, analytical chemistry, and biochemistry of beryllium are summarized. The analytical chemistry section discusses ashing, separation, gravimetric, volumetric, spectrophotometric, fluorometric, emission, activation, gas chromatographic, atomic absorption, polarographic, and miscellaneous techniques. The biochemistry portion concentrates on beryllium disease, mechanism of beryllium action, and indices of exposure. (318 references) (auth)

13611 EXTRACTION-PHOTOMETRIC AND FLUORIMETRIC DETERMINATION OF THORIUM, NEODYMIUM, YTTRIUM, AND URANIUM AS THE IONIC ASSOCIATES WITH CHELATING REAGENTS AND RHODAMINE DYES. Alimarin, I. P.; Golovina, A. P.; Runov, V. K. (Moscow State Univ.). Bull. Acad. Sci., USSR, Div. Chem. Sci. (Engl. Transl.); 23: No. 6, 1347-1349(Jun 1974).

Translated from Izv. Akad. Nauk SSSR, Ser. Khim.; 23: No. 6, 1423-1425(Jun 1974).

Thorium, the rare-earth elements, and uranium form benzene-extractable ionic associates with 8-hydroxyquinoline, its derivatives, and rhodamine dyes. The method of mathematical planning of the experiment was used to find the optimum conditions for the formation of a number of nonfluorescent and fluorescent ionic associates. A mechanism was proposed for the luminescence of the studied compounds, which was verified for more than 20 elements. (auth)

13612 DETERMINATION OF RARE EARTH ELEMENTS USING X-RAY EXCITED EMISSION SPECTROMETRY. Shinji, K.; Mizuhara, Y.; Sunahara, H.; Ishizuka, T. (Government Industrial Research Inst., Nagoya, Japan). Nagoya Kogyo Gijutsu Shikensho Hokoku; 22: No. 12, 451-456(Dec 1973). (In Japanese).

In order to determine the trace amounts of rare earth elements in yttrium oxide or cerium oxide, x-ray-excited emission spectrometry was used. This method is based on the change of spectrum intensity of luminescence on x-ray-excited sample surface. The mole ratio of each rare earth element to yttrium (RE/Y) was adjuced to be $10^{-3} \sim 10^{-7}$. The rare earth elements were Pr, Dy, Tb, Sm, Eu, Nd, Gd, Ho, Er, Tm, and Yb. The sample powder was heated for one hour at 1,000°C, then pressed under the conditions of 5 kg/cm^2. The intensities of the rare earth element in Y_2O_3 showed a linear relationship with x-ray energy in 5 to 17 kV, and again showed another linear relationship with x-ray energy in 17 to 45 kV. X-ray energy of 17 kV corresponded with K-absorption edge of yttrium. The best condition for determining the rare earth element was 40 kV, 30 mamp for x-ray energy. A linear relationship between the mole ratio (RE/Y) and the intensities was found in the range of the mole ratio of 10^{-3} to 10^{-8}. The detection limit shown as the ratio of the rare earth element to Y, were 10^{-8} for Tb and Dy, 10^{-7} for Pr, Sm and Eu, 10^{-6} for Nd and Ho, and 10^{-5} for Gd, Er, Tm and Yb. (auth)

13613 SEPARATE SPECTROPHOTOMETRIC DETERMINATION OF LANTHANUM AND CERIUM WITH CARBOXYNITRAZO IN THE PRESENCE OF OTHER RARE-EARTH ELEMENTS. Romanov, P. N. (All-Union Scientific-Research and Planning Inst. of the Tech. of Chemical and Petroleum Apparatus Construction, Volgograd). Ind. Lab. (USSR) (Engl. Transl.); 40: No. 6, 777-779 (Jun 1974).

Translated from Zavod. Lab.; 40: No. 6, 630-632(Jun 1974).

A procedure for the spectrophotometric determination of La or Ce in unalloyed or alloyed steel using carboxynitrazo as the color reagent is reported. The color reactions of the other rare earths with this reagent are completely masked by the presence of Fe^{3+} and EDTA with the exception of Pr and Nd. In the analysis of unalloyed steel it is necessary to remove the alkaline earth metals and Cr and Ni must be removed in the case of alloyed steels. In unalloyed steel Ce or La concentrations down to 0.025% can be determined in steels containing up to 23% Cr. (JSR)

13614 X-RAY SPECTRAL DETERMINATION OF NIOBIUM AND TANTALUM BY USE OF AN INTERNAL STANDARD. Obol'yaninova, V. G.; Popova, V. I.; Smagunova, A. N.; Losev, N. F. App. Metody Rentgenovskogo Anal.; No. 13, 134-139 (1974). (In Russian).

In determining Nb and Ta by use of an internal standard the K_α line of Nb (λ = 0.749 Å) and the L_α line of Ta (λ = 1.518 Å) serve as analytical lines, while the K_α line of Mo (λ = 0.707 Å) and the K_α line of zinc (λ = 1.437 Å) are used as internal standards. On adding Zn and Mo (5% each) to Nb and Ta the results of tests showed that the determination of Ta depends on the particle size of the internal standard. The best results were obtained by using sodium tetraborate as a flux for the Zn and Mo compounds and a small amount of sodium bifluoride to dissolve the Nb and Ta minerals. The optimum ratio of flux to Nb or Ta mineral was 5 to 1. The total experimental error was 3.0% for the Nb determination and 5.0% for the Ta determination. (SJR)

13615 SPECTROPHOTOMETRIC ANALYSIS OF PLUTONIUM IN NITRIC ACID SOLUTIONS. Nagar, M. S.; Gupta, S. K.; Natarajan, P. R. (Bhabha Atomic Research Centre, Bombay). pp 251-265 of Proceedings of the Chemistry Symposium. Vol. II. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P2.

Results from an investigation to standardize a method to determine the concentration of plutonium in nitric acid solutions containing mixed oxidation states are reported. (auth)

13616 VOLUMETRIC DETERMINATION OF PLUTONIUM USING REDOX INDICATOR. Chitnis, R. T.; Chitale, S. G.; Dakshinamoorthy, A.; Dubey, S. C.; Varghese, K. (Bhabha Atomic Research Centre, Bombay). pp 267-274 of Proceedings of the Chemistry Symposium. Vol. II. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P2.

The volumetric method using a redox indicator has been found to be a simple and accurate method for the determination of plutonium in plutonium product solutions. The method requires no special analytical equipment and each analysis does not exceed 30 minutes. (auth)

13617 METHOD FOR THE DETERMINATION OF SMALL QUANTITIES OF TELLURIUM IN STEELS. Filep, G.; Balogh, J. Kohaszat; 107: No. 2, 75-76(1974).

An analytical method for the determination of tellurium up to concentrations of 0.4% with an accuracy of at least two decimals was developed. Steel swarf is dissolved in hydrochloric acid in the presence of potassium chlorate. After the separation of silicon, metallic tellurium is precipitated from the acid solution with sodium sulfite. The solution containing the precipitated tellurium is filtered through sintered glass using a water jet, the tellurium on the filter dissolved in concentrated sulfuric acid and the concentration of the carmine telluric sulfoxide obtained in this manner is adjusted with concentrated sulfuric acid to a value that lends itself to photometric determination. This is performed with a Pulfrich photometer using a green (5) filter. Then the results are evaluated by means of a calibration diagram. The measurement can also be performed with a Spectromom 202 apparatus at 530 nm wavelength. The method is applied to the analysis of free-cutting steels. (Hung. Tech. Abstr.)

13618 SEPARATE AND SIMULTANEOUS EXTRACTION-SPECTROPHOTOMETRIC DETERMINATIONS OF TRACES OF MOLYBDENUM AND TUNGSTEN BY MEANS OF O-XYLENE-4, 5-DITHIOL, A NEW DITHIOL. Hoyer, E.; Mueller, H.; Wagler, H. (Karl Marx Univ., Leipzig). Wiss. Z. Karl-Marx-Univ., Leipzig, Math.-Naturwiss. Reihe; 21: No. 1, 47-61(1972). (In German).

Dissolve a few μg of sample in 2 ml of 10N HCl, add 10 ml of a 0.5% reagent solution and dilute to 20 ml. Leave for 10 min then shake for 10 sec with 25 ml of CCl_4. After 1 min separate the organic phase and measure its extinction at 670 and 690 nm (for Mo). To the aqueous phase add 3 drops of 1% $TiCl_3$ solution, warm on a water bath for 10 min, add 5 ml of the reagent solution, warm again on the water bath for 15 min, then cool for 10 min. Extract with 25 ml of CCl_4 and measure the extinction of the organic phase at 650 and 670 nm (for W). For determination of Mo plus W, dissolve the sample in 2 ml of 2.5N HCl, add 15 ml of the reagent solution and dilute to 20 ml. Place on a water bath at 90°C for 20 min, cool for 10 min, extract with 25 ml of CCl_4 and measure the extinction of the organic phase at 640 and 700 nm. (Anal. Abstr.)

13619 EMISSION-SPECTROGRAPHIC DETERMINATION OF LANTHANUM OXIDE IN YTTRIUM OXIDE IN AN ARGON-OXYGEN ATMOSPHERE. Dittrich, K.; Thuemmler, W.; Niebergall, K. (Karl Marx Univ., Leipzig). Wiss. Z. Karl-Marx-Univ., Leipzig, Math.-Naturwiss. Reihe; 21: No. 1, 31-35(1972). (In German).

Traces (down to 0.5 ppM) of La_2O_3 in yttrium oxide are determined spectrographically, with special carbon electrodes, in a stream of Ar-O (3 : 2) at 200 liters per hr. The intensity of the 412 · 323-nm La line is measured with the Y 399 · 743-nm line as reference. (Anal. Abstr.)

13620 DIRECT-CURRENT POLAROGRAPHIC DETERMINATIONS OF YTTERBIUM IN MIXED LANTHANIDE OXIDES. Kirmse, E. M.; Schilbach, U. (Paedagogical Inst., Koethen, Ger.). Wiss. Z. Karl-Marx-Univ., Leipzig, Math.-Naturwiss. Reihe; 21: No. 1, 27-29(1972). (In German).

Dissolve ≈400 mg of sample in HCl (1 : 1), and evaporate the solution to dryness. Transfer the residue to a 10-ml flask, neutralize to bromocresol green with 0.1N-LiOH and make up to volume with Li acetate buffer solution of pH 6.8. Carry out polarography on 5 ml of the resulting solution at −1.0 to −1.8 V, with use of a silver-AgCl electrode, a dropping-mercury electrode, and H as inert gas. Compare the results with those obtained on a solution of pure Yb_2O_3 in HCl, neutralized to thymol blue. (Anal. Abstr.)

13621 CONTRIBUTION TO THE DETERMINATION OF MICROQUANTITIES OF URANIUM IN WATER. Mihalik, B. (Povodie Hrona Podnik pre Spravu Tokov, Banska Bystrica, Hungary). Chem. Listy; 68: No. 12, 1278-1281(Dec 1974). (In Czech).

A procedure is described for the isolation of uranium salts from superficial waters using a sorption on activated charcoal and spectrophotometric determination of uranium with arsenazo III in acid medium (pH = 2). The method permits microdetermination of uranium in various superficial waters. (auth)

13622 DETERMINATION OF THE ISOTOPE DISTRIBUTION IN NON-STATISTICAL ^{15}N-LABELLED HYDRAZINE SALTS BY OXIDATION TO NITROGEN. Wahren, M.; Lorenz, B. (Zentralinstitut fuer Isotopen- und Strahlenforschung, Leipzig). Isotopenpraxis; 10: No. 7, 273-275(Jul 1974). (In German).

An analysis method was developed for the determination of the isotope distribution in ^{15}N-labelled hydrazine. The isotope distribution can be determined by oxidation of the hydrazine with iodine solution or alkaline permanganate solution to nitrogen with subsequent mass spectroscopic analysis. The nitrogen formed has the same isotopic composition as the hydrazine. (tr-auth)

13623 DETERMINATION OF BERYLLIUM, CADMIUM, AND TELLURIUM IN ANIMAL TISSUES USING ELECTRONICALLY EXCITED OXYGEN AND ATOMIC ABSORPTION SPECTROPHOTOMETRY. Lockwood, T. H.; Limtiaco, L. P. (National Inst. for Occupational Safety and Health, Cincinnati). Amer. Ind. Hyg. Ass. J.; 36: No. 1, 57-62(Jan 1975).

A method using electronically excited oxygen for the destruction of organic matter and atomic absorption spectrophotometry for the determination of beryllium, cadmium, and tellurium in animal tissues is presented. Samples are solubilized in dilute aqua regia after being subjected to an oxygen plasma, low-temperature (<190°C) ashing system for 20 to 30 hours. Recovery data from spiked NBS freeze-dried bovine liver indicate a quantitative determination for the three elements. Limits of detection in micrograms of element per milliliter of solubilized sample solution are: beryllium, 0.05; cadmium 0.05; and tellurium, 0.50. Beryllium, cadmium, and tellurium assay data are reported for the fresh tissues of albino rats exposed to inorganic chemicals by oral or intraperitoneal routes. The tissues analyzed include: adrenal, brain, femur, heart, kidney, liver, lung, mesenteric lymph node, pancreas, prostate, seminal vesicle, spleen, testicle, and tracheal-bronchial lymph node. (auth)

13624 SYNERGETIC EXTRACTION AND SPECTROPHOTOMETRIC DETERMINATION OF COPPER IN IRON. Gawali, S. B. Shinde, V. M. (Shivaji Univ., Kolhapur, India). Separ. Sci.; 9: No. 5, 451-458(1974).

A method was developed for synergetic extraction and subsequent spectrophotometric determination of Cu(II). The Cu(II)-benzoinoxime–pyridine complex extracted into chloroform has a characteristic green color measurable at 440 nm. The system conforms to Beer's law and is free from a large number of cation interferences. A systematic study of copper separation from metal ions, such as Fe, Au, Co, Ni, Cr, Mn, Zn, Pb, and U, was investigated and is reported. (auth)

13625 POTENTIOMETRIC DETERMINATION OF BORON IN BOROSILICATE GLASSES. Kochen, R. L. (Dow Chemical Co., Golden, CO). Anal. Chim. Acta; 71: No. 2, 451-457(Aug 1974).

Raschig rings used as a safety mechanism, to avoid critical reactions in solutions containing radioactive materials, are usually made of borosilicate glass. Since boron is the active neutron absorbing ingredient, it is important to determine the boron content in the Raschig rings at any given time. A method has been developed to determine rapidly the boron content of borosilicate glasses. Ion exchange and potentiometric measurement are used to determine boron as the tetrafluoroborate ion. The precision of the method is ±2.0 mV. The average difference between values of a wet chemical analysis and those of the potentiometric method is 7.7%. (NL)

13626 ION-EXCHANGE SEPARATION AND SPECTROPHOTOMETRIC DETERMINATION OF ZIRCONIUM, THORIUM, AND URANIUM IN SILICATE ROCKS WITH ARSENAZO III. Kiriyama, T. (Kagoshima Univ., Japan); Kuroda, R. Anal. Chim. Acta; 71: No. 2, 375-381(Aug 1974).

A combined chromatographic-spectrophotometric method was developed for the simultaneous determination of thorium, zirconium, and uranium in silicate rocks. After sample decomposition with a mixture of perchloric and hydrofluoric acids, the three metals are precipitated with iron(III) and aluminium hydroxides, and adsorbed by anion-exchange on a Dowex 1-column from dilute sulfuric acid containing hydrogen peroxide. The adsorbed thorium, zirconium, and uranium are separated by elution with acid ammonium sulfate solution, hydrochloric acid, and perchloric acid, respectively. The sorption from sulfate media and subsequent elution provide selective separation of thorium, zirconium, and uranium, allowing their direct spectrophotometric determination with arsenazo III. Results on the determination of thorium, zirconium, and uranium in standard rocks of the U. S. and Japan Geological Survey are quoted. (NL)

Radiometric and Radiochemical Procedures

Refer also to abstracts 14016, 14029, 14031, 14060, 14061, 14074, 14075, 14087, and 14402.

13627 (CEA-R-4625) DETERMINATION OF BURN-UP IN NUCLEAR FUELS BY ALPHA AND GAMMA SPECTROMETRY. Monier, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91—Gif-sur-Yvette (France). Div. de Metallurgie et d'Etude des Combustibles Nucleaires). Dec 1974. 120p. (In French). Dep. NTIS (US Sales Only) $9.00.

Thesis.

The neutronic development of a nuclear fuel is reviewed and burnup defined. Several methods of determination are then described; in that dealt with here the mass of uranium is measured by alpha spectrometry and the corresponding number of fissions by gamma spectrometry. The results obtained are very satisfactory for metallurgical studies, while a relative burnup can be obtained by comparison of the number of ^{134}Cs and ^{137}Cs atoms. For nondestructive examinations, gamma spectrometry offers several burnup determination possibilities. (auth)

13628 (CONF-741212-4) HIGH-RESOLUTION LIQUID SCINTILLATION METHOD FOR THE ANALYTICAL DETERMINATION OF ALPHA-EMITTERS IN ENVIRONMENTAL SAMPLES. McDowell, W. J. (Oak Ridge National Lab., Tenn. (USA)). 1974. 20p. Dep. NTIS $4.00.

From scintillation and semiconductor counter symposium; Washington, District of Columbia, USA (11 Dec 1974).

Appropriate optical and electronic components used in conjunction with an improved scintillator solution allow alpha liquid scintillation spectroscopy with an energy resolution of 200 to 300 keV and a background of 0.01 to 0.005 cpm. Liquid-liquid extraction procedures allow selective extraction of nuclides of interest directly into the scintillator. Applications to environmental samples are illustrated. (auth)

13629 (COO-535-710, pp 113-116) X-RAY FLUORESCENCE TRACE ELEMENT ANALYSIS. Alfrey, A. C.; Ristinen, R. A.; Rudolph, H.; Smythe, W. R.; Trish, J. W. V. 1 Nov 1974.

In technical progress report, November 1, 1973–November 1, 1974.

13630 (INS–764, pp 77-79) RADIOACTIVE ELEMENTS IN NIUE ISLAND ROCKS, SOILS, AND VEGETATION. Whitehead, N. E.; Ditchburn, R. G. Apr 1974.

13631 (INS-R-136) SUMMARY OF CURRENT APPLICATIONS OF PROTON-INDUCED X-RAY FLUORESCENCE. Whitehead, N. E. (Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Physics and Engineering Lab.). Oct 1973. 24p. INIS.

A brief review of the method is given with eighteen representative references. The method is being applied for the determination of iodine and cesium in natural waters, trace elements in dental enamel, tungsten in plants and soils (using chemical preconcentration), sodium in charcoal, trace elements in fossil soils, lead in soils (motor vehicle pollution), platings on electrical contacts, molybdenum in bacteria, trace elements in parts of flowers, elements possibly involved in trace amounts in health (Cr, Mo, Se), elements deposited in urban air filters, and foreign material on ceramic insulators. It is emphasized the technique is one of microanalysis rather than trace analysis. (auth)

13632 (LA-UR-74-1796) QUANTITATIVE DETERMINATION OF FISSION PRODUCTS IN IRRADIATED FUEL PINS USING NONDESTRUCTIVE GAMMA SCANNING. Phillips, J. R.; Waterbury, G. R.; Vanderborgh, N. E.; Marshall, T. K. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 21p. (CONF-741221-2). Dep. NTIS $4.25.

From 3rd interamerican meeting on radiochemistry; Sao Paulo, Brazil (2 Dec 1974).

A computer-controlled gamma scanning system was applied to the nondestructive determination of fission products in irradiated uranium-plutonium carbide and oxide fuel pins. The quantitative determinations were made possible by a detailed calibration of the gamma scanning system including: measurement of the effective collimating slit, detector surface response functions, and the development of a computer code for simulation of various source geometries. Following the nondestructive gamma scanning examinations of the irradiated fuel materials, the samples were dissolved remotely, and analyzed independently by well-proven radiochemical methods. The gamma scanning results differed by an average of 3.2% and 3.7% for three fission products (^{106}Ru–^{106}Rh, ^{137}Cs, and ^{144}Ce–^{144}Pr) in three (U, Pu) carbide samples and three UO_2–PuO_2 samples, respectively. These data indicate that precision gamma scanning can be applied to the nondestructive

determination of fission products in irradiated (U, Pu) carbide and oxide fuel pins. (auth)

13633 (LBL-3221) STRONTIUM-90 AND STRONTIUM-89: A REVIEW OF MEASUREMENT TECHNIQUES IN ENVIRONMENTAL MEDIA. Budnitz, R. J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Oct 1974. Contract W-7405-eng-48. 15p. (CONF-741221-1). Dep. NTIS $4.00.

From 3rd interamerican meeting on radiochemistry; Sao Paulo, Brazil (2 Dec 1974).

The primary sources of environmental ^{89}Sr and ^{90}Sr are indicated. Methods for their determination in air, water, milk, and other media (principally foodstuffs and soil) are described. Interferences, calibration techniques, and quality control in the measurements are considered. (JSR)

13634 (RI-7) TRITIUM RADIOACTIVITY MEASUREMENT IN ELECTROPHOREGRAMS ON AGAR-AGAR. Vdovenko, V. M.; Bobrova, V. N.; Rys'ev, O. A.; Gavrilenko, I. S. (Radievyj Inst., Leningrad (USSR)). 1973. 11p. (In Russian). INIS.

Test results are presented on a method of extracting water-soluble proteins of a melanoma into liquid scintillators. It is shown that the efficiency of counting the soft beta radiation of tritium on using this method is ~2%. It was possible to shorten the time required to extract the radioactive material from an agar-agar medium from 20 days to 4 hours by replacing the toluene scintillator by a dioxane scintillator. In order to increase the counting efficiency and the efficiency of the overall measurement without destroying the electrophoregram it was proposed that a finely-dispersed scintillator be introduced into the gel during its preparation. The counting efficiency is 3.5 ± 0.5%, with the use of a scintillation scanning device. Powder impurity of organic scintillator does not distort the distribution picture of water-soluble protein fractions of the melanoma, but increases somewhat the time of separation. (tr-auth)

13635 (RT/PROT-(74)23) DETERMINATION OF PLUTONIUM-239 IN ANIMAL TISSUES AND EXCRETA. The Application of Liquid Scintillation Counting and Extraction Chromatography. Delle Site, A.; Santori, G.; Bazzarri, S. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Sep 1974. 23p. Dep. NTIS (US Sales Only) $4.25.

The purpose of this work is to illustrate the methods adopted for the determination of ^{239}Pu in tissues, urine, and feces of mice. A preliminary study, regarding the quenching effects involved in the α counting of plutonium by liquid scintillation, indicates HCl as the most suitable aqueous medium. The procedure adopted for the preparation of samples for liquid scintillation counting is described. The organic matter is removed by dry ashing and wet treatment with concentrated HNO_3 and the α' counting of plutonium is performed with Insta-Gel as scintillation liquid. Nearly 100% plutonium recoveries are achieved and the minimum detectable level is 1-2 pCi for a 100-minute count. The analysis of plutonium in urine and feces of mice are carried out by separation of the element on a microthene-tri-n-octylphosphine oxide (TOPO) column and α'-counting by a ZnS(Ag) detector. The minimum detectable levels are 0.1 and 0.4 pCi for urine and feces respectively for a 100-minute count. (auth)

13636 X-RAY RADIOMETRIC DETERMINATION OF TITANIUM AND VANADIUM IN CERTAIN TECHNOLOGICAL MATERIAL AND ORES. Shmonin, L. I.; Gorelkinskaya, S. I.; Mager, E. V.; Gorbachev, A. I. (Kazakh State Univ., Alma-Ata, USSR). Ind. Lab. (USSR) (Engl. Transl.); 40: No. 6, 834-835(Jun 1974).

Translated from Zavod. Lab.; 40: No. 6, 678-679(Jun 1974).

A procedure was developed for the x-radiographic determination of Ti and V in V slag, complex Ti melts, and ores. The characteristic Ti radiation is separated by the use of a Sc K filter and an iodine L filter, and a Ti K filter and an iodine L filter are used to resolve the Kα lines of Ti. The effect of Fe on the accuracy of the determination was evaluated and showed that errors in the determination of the Fe content will cause a relative error of ~2% in the Ti and V determinations. Therefore the method can be used for the rapid x-ray radiometric determination of TiO_2 and V_2O_5 in Ti-magnetite ores. (JSR)

13637 DEPTH PROFILE DETERMINATION BY ION-INDUCED X-RAY SPECTROSCOPY. Pabst, W. (Technische Univ., Muenchen (F.R. Germany)). Nucl. Instrum. Methods; 120: No. 3, 543-545(15 Sep 1974).

Until now, no depth profile of trace elements was determined by ion-induced x-ray spectroscopy. This letter examines the chances to unfold a profile from measurements at various angles between target and detector. (auth)

13638 ELEMENTAL ANALYSIS FROM THE CHARACTERISTIC X-RAY RADIATION EXCITED BY ACCELERATED PROTONS. Strashinskii, A. G.; Khomyakov, G. K.; Skakun, N. A.; Serykh, N. V.; Klyucharev, A. P. Sov. At. Energy (Engl. Transl.); 36: No. 5, 511-513(May 1974).

Translated from At. Energy.; 36: No. 5, 401-403(May 1974).

The microcontent of different elements was determined with the use of characteristic x-ray radiation excited by accelerated protons. Weak solutions of iron, nickel, copper, gallium, and tantalum were deposited on carbon films of thickness not exceeding 20 $\mu g/cm^2$. These samples were irradiated with a 3-MeV proton beam. (LK)

13639 CONTRIBUTION TO THE RADIORELEASE DETERMINATION OF OZONE USING RADIOACTIVE CLATHRATE OF ^{85}Kr. Pruzinec, J.; Tolgyessy, J.; Naoum, M. M. (Technical Univ., Bratislava). Radiochem. Radioanal. Lett.; 20: No. 1, 73-76 (18 Dec 1974).

Chromatographic papers impregnated with hydroquinone and kryptonated with diffusion technique were used for the determination of ozone. The determination is based on measuring the residual activity of the impregnated papers after their reaction with samples containing ozone. (auth)

13640 FEASIBILITY OF USING Ge(Li) DETECTORS TO ANALYZE RADIOACTIVE ORES. Shumilin, I. P. At. Energ. (USSR); 37: No. 5, 384-389(Nov 1974). (In Russian).

The feasibility of using Ge(Li) detectors of gamma radiation to determine naturally radioactive elements in material being analyzed without chemical treatment is examined. Gamma spectra of pitchblende samples (before and after annealing at 1000°C), Ra, U_3O_8, UX_{1+2}, Io, RaD and monazite, obtained with Ge(Li) detectors having volumes of 0.5 to 90 cm^3 and resolutions of 0.5 to 3.0 keV, are researched. Gamma-spectra regions of practical interest for analytical studies are described and formulas are proposed for the determination of all naturally radioactive elements in ores and products of their technological treatment. For increased accuracy, it is recommended to anneal samples at 1000°C before analysis. (auth)

13641 X-RAY RADIOMETRIC, FLUORESCENCE METHOD OF DETERMINING MOLYBDENUM IN ORES. Zhabin, E. G.; Krampit, L. A. App. Metody Rentgenovskogo Anal.; No. 13, 259-262(1974). (In Russian).

The results of x-ray radiometric fluorescence analysis of ores for molybdenum content are considered. Saturated layers of sample are analyzed with the use of commercial radioisotopic sources of ^{109}Cd and ^{147}Pm. The results indicate the suitability of using these radioisotopic sources in determining molybdenum content by fluorescence analysis. (SJR)

13642 POSSIBILITIES OF USING ALPHA-EXCITATION IN X-RAY SPECTRAL ANALYSIS WITHOUT A CRYSTAL. Vander, I. Z.; Gerling, V. E. App. Metody Rentgenovskogo Anal.; No. 13, 176-181(1974). (In Russian).

A comparative analysis is presented of methods of exciting x-ray radiation of elements having an atomic number $Z < \lambda$ 20. A high quantum yield of characteristic radiation is assured by a primary, alpha emitter. An expression is obtained for calculating the intensity of x ray radiation excited in a sample by a beam of alpha particles. The effects of atomic number and selective absorption are discussed. The results of determining magnesium, aluminum, and silicon in soils and minerals are considered. The threshold of sensitivity is 0.03 to 0.2%. (SJR)

13643 RAPID DETERMINATION OF RADIONUCLIDES IN MILK. Results of an Intercomparison Organized Jointly by the IAEA and CEC. Suschny, O. (International Atomic Energy Agency, Vienna); Heinonen, J.; Merten, D.; Smeets, J.; Amavis, R.; Bonini, A. (IAEA, Vienna). pp 359-392 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); (CONF-731117-(P1).

An intercomparison of the rapid determination of radionuclides (^{89}Sr, ^{90}Sr, ^{131}I, ^{137}Cs, ^{140}Ba) in milk at concentrations that might be expected in the vicinity of a nuclear installation in the case of an unplanned or accidental release of radioactive products was organized jointly by the IAEA and CEC. The purpose of the project was to enable laboratories in Member States of one or both of the organizations to check the speed and the accuracy of their analytical work and to help administrative departments who are responsible for the protection of the public from undue exposure to radiation and radioactive materials to assess the reliability of the data

which, in any real case, would form the basis for administrative action. Two solutions containing mixtures of the nuclides at two different concentration levels (known to the organizers but unknown to the participants) were analyzed at 34 laboratories. Preliminary results were to be obtained and reported after four hours time for analysis; this done, ample time was provided to check the results and report final values. In the case of the three gamma emitters this time schedule was adhered to by most analysts, the strontium isotopes, however, proved more difficult and caused delays at some laboratories. Of the 354 results reported for all the gamma emitters, 9 had to be rejected, while the standard deviation of the accepted values from the mean varied from 6.7% to 18.7% for the individual nuclides. The corresponding figures for the strontium were: 126 results received, 8 excluded, standard deviation 11.3% to 45.3%. (auth)

13644 DETERMINATION OF SUCROSE IN SUGAR-BEET BY THE ISOTOPE-DILUTION METHOD. Gruszecka, H. Gaz. Cukrow.; 80: 139-140(1972). (In Polish).

Isotope dilution, with use of [^{14}C]sucrose (8.5 μCi per 100 mg) and a Geiger-Mueller tube, was used to demonstrate the influence of the quality of the beet sample on the polarimetric determination of sugar. For samples of good-quality beet (containing ≈19.3% of sucrose), results by the isotopic method differed by +0.02% to −0.38% from those of polarimetric determinations; values for deteriorated beet (with ≈14.2% of sucrose) showed differences of −0.61% to −2.13%, thus confirming that optically active products of decomposition of beet tend to elevate the polarimetric results. (Anal. Abstr.)

13645 A METHOD FOR READING OF THE RESIDUAL BETA-ACTIVITY IN PLANTS IN THE RADIOMETRIC DETERMINATION OF ^{40}K. Vasilev, V. Vet. Med. Nauki (Sofia); 10: No. 5, 61-65 (1973). (In Bulgarian).

A method is suggested for measuring the residual beta-activity through the radiometric evaluation of ^{40}K. A brief radiochemical analysis is carried out in which a water extraction of K is made from the plant ash. Through carbonate sedimentation of the potassium filtrate ^{90}Sr and ^{89}I are separated, followed by the fixation of ^{137}Cs by the use of an absorbent (AMP). The filtrate is concentrated and its activity (^{40}K) is measured. The ash is also measured to establish its beta activity. A formula is suggested to determine the residual beta activity, which gives the difference between the total beta activity of the sample and the beta activity of the ^{40}K contained. The reliability of the method proposed is checked by comparative experiments with plant samples in which the residual beta activity is measured through the recalculation of the flame photometry value of ^{40}K and through its radiometric reading. The difference obtained between the two methods is negligible. Radiometric determination of ^{40}K as an index of the residual beta activity of plants may be routinely employed in the radiometric laboratories. (auth)

13646 THE DETERMINATION OF CALCIUM-45 IN SEA WATER, CORALS AND CALCAREOUS ALGAE BY LIQUID SCINTILLATION COUNTING. Boehm, E. L. (Cape Town Univ. (South Africa). Dept. of Biochemistry); Goreau, T. F. Trans. Roy. Soc. S. Afr.; 41: No. 1, 25-32(Mar 1974).

15 refs.

Calcium isolated from various fractions of corals and algae is converted into nitrate and dissolved in a water–ethyleneglycol–monoethylether–dioxane cocktail in the ratio of 1:2:20 using PPO and I-dimethyl-POPOP as scintillators. ^{45}Ca in sea water is counted directly after dilution of 1:10 with water. The carrier capacity of the system is 3 mmole Ca $(NO_3)_2$/23 ml (120 mg Ca). The counting efficiencies at minimum and maximum carrier concentration are 88.7% and 78.5% respectively. The scintillator solvent system is chemically stable and counts are highly reproducible. Instagel in the ratio of 10 ml to 1 ml aqueous solution gives counting efficiencies in the region of 80%. Seawater can be incorporated directly. Algal calcium is counted as the nitrate or the chloride. The carrier capacity of Instagel is higher and the counting efficiency is less affected by large concentrations of carrier and excess acid. (INIS)

13647 METHOD FOR MEASURING THE CHERENKOV RADIATION PRODUCED BY ^{32}P IN SMALL SAMPLE VOLUMES. Mardh, S. (Univ. of Uppsala). Anal. Biochem.; 63: No. 1, 1-4(Jan 1975).

A method for analyzing ^{32}P in small aqueous samples by measuring the Cherenkov radiation is described. Centering problems with small sample volumes are eliminated by placing the sample in a polystyrene tube in the scintillation vial. The detection efficiency is high, 54.5 ± 0.6% (2 SD) at a sample volume of 25 μl. The reproducibility is good and independent of the sample volume. The detection efficiency of ^{32}P in polyacrylamide gel is shown to be as good as in water. (auth)

13648 SAMPLE PREPARATION METHOD AND APPARATUS. Kaartinen, N. H. (to Packard Instrument Co., Inc.). US Patent 3,830,628. 20 Aug 1974. Filed Date 10 Apr 1972. 26p.

Method and apparatus for the processing of fluid materials, particularly for the preparation of samples for radioactive isotope tracer studies by combustion of starting materials containing such isotope tracers are given. A starting material is burned in a combustion chamber. The combustion products are continuously exhausted from the combustion chamber and passed sequentially through a heat exchanger, one or more first exchange columns, a reaction column (if there is a radioactive isotope tracer remaining in gas form), and a second exchange column. Oxygen is fed into the combustion chamber at a controlled rate during combustion, and after combustion inert gas and injected water are fed into the combustion chamber and exhausted therefrom through the entire apparatus, so as to purge it of any remaining gaseous combustion products. The heat exchanger condenses most of the condensable vapors in the combustion products from the combustion chamber, and these condensed vapors (along with vapor from the injected water) are separated from the gases and collected in a first counting vial. The gases containing the remaining condensable vapors that pass into the first exchange columns are mixed therein and exchanged with a liquid. A first liquid scintillator is introduced to the first exchange columns and the direction of gas flow is then reversed therein to thereby discharge the residual liquid and scintillator liquid into the first counting vial. The uncondensed gases from the first exchange columns (containing the radioactive isotope tracer) which pass into the reaction column are reacted with a trapping agent therein, the reaction column comprising a series of smoothly contoured reaction chambers interconnected by smoothly contoured necked down portions. Untrapped gases discharged from the reaction column are passed through the second exchange column, comprising a series of bulbous chambers of small diameter relative to the reaction column, where they are scrubbed of any residual reaction products. A second liquid scintillator is introduced to the second exchange column and the direction of gas flow is then reversed therein, and in the reaction column, to thereby discharge the reaction products and scintillator liquid into a second counting vial. The apparatus is then cleaned by (a) passing inert gas along with additional injected water into the combustion chamber in a direction concurrent with the previous flow therein of combustion products, thence through the heat exchanger and into a waste receiver, (b) passing inert gas along with added water through the first exchange columns in a direction countercurrent to the previous flow therein of combustion products, and thence into the waste receiver, and (c) passing inert gas through the second exchange column in a direction countercurrent to the previous flow therein of combustion products, and thence through the reaction column and to waste. (Official Gazette)

13649 X-RAY FLUORESCENCE ANALYSIS. Excitation of Carbon X-fluorescence Radiation Using a Combined Photon–Electron Tube. Application to the Determination of C in Steels. Vie le Sage, R.; Bocquillon, P.; Faucherre, J. (Univ., Paris). Compt. Rend., Ser. C; 279: No. 4, 125-127(22 Jul 1974). (In French).

The x-ray fluorescence of light elements such as carbon is not energetic enough to be excited by a conventional sealed tube. By the use of a combined photon-slow electron tube the long-wave region (more than 20 A) can be reached without special technological difficulties. Passage to the stage of quantitative carbon analysis in steels requires the control of certain parameters, the study of which is broached here. (FR)

Separation Procedures

Refer also to abstracts 13771, 13794, 14068, 14141, and 15645.

13650 (GKSS–74/E/5) DETERMINATION OF THE CHARACTERISTIC DATA OF ION EXCHANGE RESINS. Hattenbach, K.; Weiler, K. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m. b. H., Geesthacht-Tesperhude (F. R. Germany)). 1974. 21p. (In German). INIS.

One of the tasks of the EFDR-80 study is to develop a boric acid control system, which requires detailed information about the characteristic data of ion exchange resins as the separation of boric acid is to be done by ion exchangers. Hence, the maximum capacity of the two ion exchange resins amberlite IRN-78 and lewatite M500 at 20°C and their saturation capacity for boric acid concentrations up to 1,000 ppM, relative to boron at temperatures from 10 to 50°C, has been measured. Furthermore, the boric acid separation during discontinuous operation and the data describing the regeneration of the resins were determined. (auth)

13651 (IPNO-T-74-10) SOLVENT EXTRACTION OF RARE EARTH AND ACTINIDE ELEMENTS FROM MOLTEN SALTS. Foos, J. (Paris-11 Univ., 91-Orsay (France). Inst. de Physique Nucleaire). 1974. 110p. (In French). Dep. NTIS (US Sales Only) $8.50.

Thesis.

The mechanisms of solvent extraction from molten eutectic $LiNO_3-KNO_3$ by TBP, TPPO or TTA diluted in a polyphenyl mixture were studied. The distribution coefficients of lanthanides, actinium, thorium and 5f series elements up to californium were measured at 150°C by α, β, or γ radiometry, according to the nuclides which were used. Trivalent elements easily oxidable to 4 oxidation state have a behaviour dependent on their concentration and affinities with oxide anions. Some spectrophotometric studies (uv or ir) were investigated, in order to study, first the interactions of matter with neodymium nitrate in the fused salt, then the solvating nitrate in polyphenyl mixture. In the case of the TTA extraction, the H^+ ions released by the chelate formation are fixed by the oxide ions and lead peculiarly to the NO_2 and O_2 formation. So the distribution of the solvated cations depends on the gaseous phase composition. This last becomes an equilibrium agent and gives a great deal of applications to this system. (FR)

13652 (LA-5728) CATION EXCHANGE BEHAVIOR OF LANTHANIDES AND TRIVALENT ACTINIDES IN ETHANOL-HYDROCHLORIC ACID. Marsh, S. F.; Ortiz, M. R.; Rein, J. E. (Los Alamos Scientific Lab., N. Mex. (USA)). Aug 1974. Contract W-7405-eng-36. 9p. Dep. NTIS $4.00.

Cation exchange in various organic solvent-hydrochloric acid media was studied for separating microgram levels of fission products from trivalent actinides. Ethanol provided the largest group separation factors. With either conventional or macroporous resins, equilibrations were too slow for useful column operation. The slow equilibration was caused by slow diffusion of the inorganic ions within the resin beads. A pellicular ion exchange resin, consisting of silica beads with a thin shell of resin, gave rapid and complete lanthanide-trivalent actinide separations. (auth)

13653 (NIIAR-P-210) EXTRACTION BY PHOSPHORORGANIC ACIDS. Part 1. Effect of the Phosphonic Acid Ester Composition and Structure on Trivalent Cation Extraction. Zaitsev, A. A.; Nazarova, I. I.; Petukhova, I. V.; Filimonov, V. T.; Yakovlev, G. N. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1973. 15p. (In Russian). INIS.

A study was carried out on the extraction of americium, curium, berkelium, californium, promethium, europium, and yttrium with diethylbenzene solutions of n-amyl, isoamyl, n-octyl, 2-ethylhexyl, and n-decyl esters of phenylphosphoric acid ($C_6H_5(RO)P(O)OH$) over a wide interval of acidity (0.1 to 8 M) of perchloric, nitric and hydrochloric acids. By these studies it was possible to establish regularities associated with the structure and composition of the esters. Lengthening the ester radical from C_5 to C_{10} leads to an increase in extractability of the phosphonates. On the other hand, branching of the ester radical near the phosphorous atom decreases the extractability of the phosphonates with the extraction of curium decreasing more rapidly than the extraction of californium with a resulting improvement in the separation of these elements. In addition, the nature of the mineral acid has a significant effect on the distribution of elements and on their separation. The following order for change in values of the distribution and separation coefficients of californium and curium was established: $HClO_4 > HCl > HNO_3$. (tr-auth)

13654 RAPID ELECTRODEPOSITION OF RADIOACTIVE RARE EARTHS. Beyer, G. J.; Herrmann, E. (Joint Inst. of Nuclear Research, Dubna, USSR). Radiochem. Radioanal. Lett.; 20: No. 1, 41-46(18 Dec 1974).

A method is described for electrodepositing carrier-free radioactive rare earth nuclides onto a small tungsten cathode. The nuclides are deposited to more than 80% in 30 to 40 sec. The whole operating time including also an evaporation step is about two minutes. (auth)

13655 STRUCTURAL ASPECTS AND SOME NOVEL FEATURES OF SYNTHETIC INORGANIC ION EXCHANGERS. Qureshi, M. (Aligarh Muslim Univ., India). pp 1-32 of Proceedings of the Chemistry Symposium. Vol. II. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P2.

Classification and novel features of inorganic ion exchangers used in nuclear engineering are given. The structure of zirconium phosphate and the mechanism of ion exchange on α-zirconium phosphate are discussed. (LK)

13656 ELECTRODEPOSITION TECHNIQUES OF ACTINIDES FOR BIOASSAY STUDIES. Rudran, K. (Bhabha Atomic Research Centre, Bombay). pp 185-191 of Proceedings of the Chemistry Symposium. Vol. II. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P2.

Trace quantities of actinides present in urine and feces samples are radiochemically separated and planchetted by electrodeposition for counting. The method of electrodeposition is discussed. (LK)

13657 SOLVENT EXTRACTION OF URANIUM FROM HYDROCHLORIC ACID SOLUTIONS BY MIXTURES OF DI-N-PENTYL SULFOXIDE AND TRI-N-BUTYL PHOSPHATE. Mohanty, S. R. (Utkal Univ., Bhubaneswar, India); Reddy, A. S. pp 193-198 of Proceedings of the Chemistry Symposium. Vol. II. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P2.

The extraction of uranium with DPSO-TBP mixtures was studied to determine whether the mixed species are formed by addition or substitution. The results tend to indicate a substitution mechanism. (LK)

13658 EXTRACTION OF THE ACTINIDES BY LONG-CHAIN AMINES. Swarup, R.; Patil, S. K. (Bhabha Atomic Research Centre, Bombay). pp 199-205 of Proceedings of the Chemistry Symposium. Vol. II. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P2.

The extraction of Np(V) and Np(VI) and other hexavalent actinides (Pu,U) with TLA and Aliquot-336 was studied. Data obtained show that PuO_2^{2+} and NpO_2^{2+} are almost equally extractable into 10% TLA and Aliquot-336 nitrate and to a larger extent than UO_2^{2+}. The order of extraction is Np(VI) > Pu(VI) > U(VI). (LK)

13659 EXTRACTION OF PLUTONIUM(VI) AND PLUTONIUM(VII) BY DIBENZOYL METHANE FROM ALKALINE SOLUTIONS. Vaidyanathan, S.; Rizvi, G. H.; Natarajan, P. R. (Bhabha Atomic Research Centre, Bombay). pp 207-213 of Proceedings of the Chemistry Symposium. Vol. II. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P2.

Results of an investigation on the extraction of Pu(VI) and Pu(VII) from alkaline solutions by dibenzoyl methane in butyl acetate which is known to extract Np(VIII) are presented. (LK)

13660 ANION EXCHANGE BEHAVIOR OF PLUTONIUM IN MIXED SOLVENTS MEDIA. I. Distribution Studies. Venkatasubramanian, V.; Perumal, K.; Pillai, N. S.; Shinde, S. S. (Bhabha Atomic Research Centre, Bombay). pp 221-227 of Proceedings of the Chemistry Symposium. Vol. II. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P2.

Distribution studies involving Pu(IV), U(VI), and some fission product ions between nitric acid-organic solvent liquid phase and Dowex 1 × 4 solid phase are described. (LK)

13661 ANION EXCHANGE BEHAVIOR OF PLUTONIUM IN MIXED SOLVENTS MEDIA. II. Breakthrough Studies. Venkatasubramanian, V.; Perumal, K.; Pillai, N. S.; Shinde, S. S. (Bhabha Atomic Research Centre, Bombay). pp 229-238 of Proceedings of the Chemistry Symposium. Vol. II. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P2.

Experimental work done to optimize conditions of loading and eluting plutonium on Dowex 1 × 4 in different compositions of methanol-nitric acid mixture is described. (LK)

13662 ANION EXCHANGE BEHAVIOR OF PLUTONIUM IN MIXED SOLVENTS MEDIA. III. Separations and Spectrophotometric Studies. Venkatasubramanian, V.; Perumal, K.; Pillai, N. S.; Shinde, S. S. (Bhabha Atomic Research Centre, Bombay). pp 239-249 of Proceedings of the Chemistry Symposium. Vol. II. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P2.

Preliminary studies indicated that mixtures of composition, 70% methanol-1.0 M nitric acid, 50% methanol-4.0 M nitric acid and 30% methanol-7.5 M nitric acid are very well suited for quantitative uptake of large quantities of plutonium by Dowex

1 × 4 at room temperature (150–200 mg Pu/g resin). Presence of uranium can be tolerated in 10–100 fold excess if allowance is given for the slightly reduced breakthrough capacity of the bed resulting from the inhibition of adsorption of plutonium by the major component. Since ions of zirconium, ruthenium, strontium, cerium, and cesium were seen to have considerably low Kd in these systems, it was concluded that an effective separation of these ions from Pu(IV) ions is possible. The medium with low nitric acid and high solvent content appeared particularly attractive as it is known that in aqueous medium using very high concentration of nitric acid, these ions have significant affinity for the exchanger requiring extensive washing of the bed to achieve a satisfactory decontamination of the plutonium product. Results of some separation schemes tried, involving Pu(IV), U(VI) and fission product ions, are given. (auth)

13663 USE OF FIBER CHROMATOGRAPHY FOR THE SEPARATION OF ^{14}C- AND ^{3}H-LABELLED COMPOUNDS. Sirokman, F.; Koves, E.; Szabo, M.; Meszaros, L. (Attila-Jozsef Univ., Szeged, Hungary). Acta Univ. Szeged., Acta Phys. Chem.; 20: No. 1-2, 183-184(1974). (In German).

The fiber chromatography method was tested for its utility in separating very small amounts of labelled compounds of biological interest. The applicability of the method was tested by the separation of the metabolites of 2-^{14}C-indole-3-acetic acid from plant material. For samples of 1 μg an activity of 10^{-4} μCi was detectable by autoradiography. In further studies fiber chromatography was successfully used for the detection of the conjugate of indole-3-acetic acid and aspartic acid existing in vivo and labelled with ^{14}C and ^{3}H respectively. (JSR)

13664 STUDIES IN SOLVENT EXTRACTION OF RUTHENIUM(III) FROM HCL SOLUTIONS BY SULFOXIDES. Saraiya, V. N.; Venkateswarlu, K. S.; Shankar, J. (Bhabha Atomic Research Centre, Bombay). Separ. Sci.; 9: No. 5, 423-429(1974).

Studies on the solvent extraction of Ru(III) by sulfoxides from hydrochloric acid solutions are reported. A kinetic effect was observed in the extraction process. The extraction efficiency varies with the nature of the sulfoxide, the diluent employed, and the molarity of the acid. (auth)

13665 REVERSE PHASE PARTITION CHROMATOGRAPHY ON PAPER IMPREGNATED WITH 1-PHENYL-3-METHYL-4-BENZOYL PYRAZOLONE-5 (PMBP). De, A. K.; Sarkar, S. K. (Visva-Bharati, West Bengal, India). Separ. Sci.; 9: No. 5, 431-439(1974).

Reverse phase partition chromatography (RPPC) on paper impregnated with 1-phenyl-3-methyl-4-benzoyl pyrazolone-5 was studied for several metal ions. Several complex mixtures of 3 to 6 metal ions were separated under different solvent conditions. The solvent mixtures were acetone-hydrochloric acid, methyl ethyl ketone–acetone–hydrochloric acid, methyl isobutyl ketone–hydrochloric acid, acetylacetone–acetone–hydrochloric acid, acetonylacetone–acetone–hydrochloric acid, and dibenzoylmethane–acetone–hydrochloric acid. Beautiful spots of metals, sharply separated from one another, were obtained within a short period of development. (auth)

13666 EXTRACTION OF TRACE AMOUNTS OF TUNGSTEN(VI) FROM DIFFERENT MINERAL ACID SOLUTIONS BY AMINE OXIDES. Ejaz, M. (Pakistan Inst. of Nuclear Science and Tech., Rawalpindi). Anal. Chim. Acta; 71: No. 2, 383-391 (Aug 1974).

The solvent extraction of tungsten(VI) from nitric, hydrochloric and sulfuric acid solution by 4-(5-nonyl)pyridine oxide and trioctylamine oxide in xylene was studied. The influence of the concentration of the solvents and salting-out agents is described. From the results of partition experiments, attempts were made to deduce the nature of the extraction process. (NL)

Inorganic, Organic, and Physical Chemistry

Chemical and Physicochemical Properties

Refer also to abstracts 14222, 14516, 14518, 14524, 14589, 14648, 15011, and 15838.

13667 (AD-781700) QUANTITATIVE ANALYSIS OF GLASS-CERAMICS BY X-RAY DIFFRACTION. Russak, M. A. (Grumman Aerospace Corp., Bethpage, N. Y. (USA). Research Dept.). May 1974. 25p. NTIS $3.00.

An x-ray powder diffraction technique similar to one used for determination of quartz content in industrial dusts was applied in determining the weight fraction crystallinity of glass–ceramics. The weight fraction of Nepheline $Na_2O \cdot Al_2O_3 \cdot 2SiO_2$ in partially devitrified glasses in the $Na_2O \cdot Al_2O_3 \cdot SiO_2$ and $Na_2O \cdot Al_2O_3 \cdot Nb_2O_5 \cdot SiO_2$ systems was determined and found to be in good agreement with determinations made by other analytical methods. This method is of particular value with glass–ceramics because it is rapid, independent of mass absorption of the sample, and, therefore, independent of other crystalline (or amorphous) phases present and accurate to plus or minus 4%. (auth)

13668 (IEA-342) SLOW NEUTRON SCATTERING CROSS SECTION OF DEOXYRIBONUCLEIC ACID, EX-THYMUS. Fulfaro, R.; Walder, V. S.; Vinhas, L. A.; Amaral, L. Q. (Instituto de Energia Atomica, Sao Paulo (Brazil)). May 1974. 21p. Dep. NTIS (US Sales Only) $4.25.

In order to study the dynamics of water present in biological molecules and the freedom of motion of the hydrogen atoms, the neutron transmission through a DNA sample was measured in the neutron wavelength interval 4.0 to 6.5 Å using a crystal spectrometer. The knowledge of the bounding state of the water present in DNA is very useful in studying structures and the functions of biological macromolecules. NMR studies suggest some form of ice-like coordination for H_2O in biological molecules, whereas results obtained from neutron inelastic scattering in polyglutamic acid suggest a behavior similar to liquid water. In the present work, measurements were performed at room temperature for a dry sample and for a wet sample with 7.8% moisture. The total cross sections, σ_T, and the scattering cross sections per hydrogen atom, $\sigma_{S/H}$, were determined in each case, thus obtaining the cross section of H_2O present in DNA. This cross section shows that the water in DNA presents a behavior similar to that of liquid water. By analyzing the $\sigma_{S/H}$ curve for dry DNA it is observed that the hydrogen atoms have not much freedom of motion in this biological molecule. (auth)

13669 (SAND-74-6021) CONTACT BETWEEN MOLTEN TIN AND WATER. Pelletier, A. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). 22 Dec 1974. Translation by M. Martin of TT-69-14-E/AP. 15p. Dep. NTIS $4.00.

Experiments of dropping molten Sn into water allow a plausible explanation to be given for the dispersion phenomenon and to illustrate the difficulties encountered in computing the phenomena. In particular, the uncertainty in the concept of a surface as one approaches atomic dimensions was established. Bibliographic investigations have shown the reservations that must be applied to the criteria for pulverization that have been set forth. In effect, it appears that it is a case of not only thermal phenomena, but likewise of surface tension forces (capture of the cold liquid by the hot liquid). A comparison with the first more realistic experiments on the contact between uranium dioxide and sodium appears to show that these materials behave like tin and water, and that simulation experiments should permit us to obtain results that will be useful for increasing the safety of fast reactors. (auth)

13670 (WANL-TME-1484) REACTIONS OF LIQUID TITANIUM AND HAFNIUM WITH CARBON. Adelsberg, L. M.; Cadoff, L. H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1966. 15p. Dep. NTIS $4.00.

The layer growth method has been used to investigate the reaction kinetics of isothermal reactions of liquid titanium (1800°-2700°C) and hafnium (2300°-3000°C) with carbon which resulted in the formation of carbon-saturated liquid metal and layers of TiC and HfC, respectively. The thickness of the carbide layers as a function of carburization time and temperature is given. At each temperature, parabolic growth behavior of scale was observed. The liquidus phase boundaries were determined from metal samples treated for different times ranging from 4 to 100 minutes at each temperature studied. Metallographic examination revealed that the carbide precipitates were distributed uniformly throughout the frozen metal matrices. Chemical analyses (+ 10% relative) of samples with the carbide layers removed showed that the carbon contents of the liquid metals were independent of the carburization time (for $t \geq 4$ minutes), thus suggesting rapid saturation of the liquid. The phase boundary compositions are listed and included in the most recent titanium-carbon and hafnium-carbon phase diagrams which are shown. The analytical chemistry data indicated oxygen contents ranging from 250 to 500 ppM in the titanium and 55 to 400 ppM in the hafnium samples. The nitrogen contents were less than 20 ppM in all samples. The mechanisms of titanium and hafnium reactions with carbon are thought to be similar to those proposed for the zirconium-carbon reaction. This reaction sequence is the rapid carbon saturation of the liquid metal followed by parabolic type growth of the carbide (TiC, ZrC, HfC) layer. The formation of these compounds occurs at the liquid metal-carbide

interface and is controlled by carbon diffusion through the carbide layers; the metal atom mobilities are thought to be much less mobile than that of carbon in these materials. This was confirmed by the absence of axial voids in fully carburized 1/2'' diameter metal rods. (auth)

13671 CHEMISTRY DATA FOR POWER. Tomlinson, M. (Atomic Energy of Canada Ltd., Pinawa, Manitoba). Chem. Can.; 26: No. 9, 21-23(Oct 1974).

Metal oxide-water interfaces are of primary importance in energy conversion in nuclear reactors, and corrosion and heat transfer at these interfaces greatly influences the cost of nuclear power. Present knowledge of metal and metal-oxide behaviour in hot light and heavy water is poor; for example, there are uncertainties in the measured and calculated values for the solubility of Fe_3O_4 in hot water. Thus, there is a great need for chemists to learn more about metal-oxide hot water systems. (RA)

13672 OXYGEN 1s BINDING ENERGIES IN OXYGEN CHEMISORPTION ON METALS. Joyner, R. W.; Roberts, M. W. (Univ. of Bradford, Eng.). Chem. Phys. Lett.; 28: No. 2, 246-248(15 Sep 1974).

The 1s binding energy, referred to the Fermi level, for oxygen adsorbed on five different metals (Ag, Cu, Ni, Mo, and W) is the same, at 530.3 ± 0.1 eV, indicating that the same oxygen species, in the same electronic environment is present on each metal. Some implications and consequences of this are discussed. (auth)

13673 INVESTIGATION OF DICHLORO- AND TRICHLOROACETIC ACID COMPLEXES OF INDIUM(III) USING RADIOACTIVE INDIUM AND LIQUID ION EXCHANGE. Lasztity, S. (Eotvos Lorand Univ., Budapest). Radiochem. Radioanal. Lett.; 20: No. 1, 7-14(18 Dec 1974).

The stability constants of the 1:1 and 1:2 complexes of indium(III) with dichloro- and trichloroacetate were determined at various ionic strengths using liquid ion exchanger (di-2-ethylhexyl phosphoric acid) and ^{114,114m}In labeling. (auth)

13674 STUDY OF THE HEAT DECOMPOSITION OF $FeSO_4 \cdot 7H_2O$ IN THE ABSENCE OF OXYGEN. Lipka, J.; Sitek, J.; Cirak, J.; Prejsa, M. (Technical Univ., Bratislava). Radiochem. Radioanal. Lett.; 20: No. 1, 59-63(18 Dec 1974).

The decomposition of $FeSO_4 \cdot 7H_2O$ was studied in the absence of oxygen in the temperature range from 20 to 810°C. The dehydration process terminated at 294°C and then the decomposition started. (auth)

13675 TRACER DIFFUSION COEFFICIENTS OF Cs^+, Sr^{++}, AND Co^{++} IN CONCENTRATED SODIUM CHLORIDE SOLUTIONS. Petschel, M.; Richter, D. Isotopenpraxis; 10: No 7, 265-269 (Jul 1974). (In German).

The tracer diffusion coefficients of Cs^+, Sr^{2+}, and Co^{2+} were measured in 0.1 to 5.2 M NaCl solutions using the radioisotopes ^{137}Cs, ^{89}Sr, and ^{60}Co. The coefficient for Na^+ was also measured for comparison of the methodical parameters with the literature values. The pattern of the theoretical curves was discussed with respect to the experimental results on the concentration dependence. (tr-auth)

13676 $CaTiO_3-La_2TiO_5$ SYSTEM. Kisel, N. G.; Liman't, F.; Mudrolyubova, L. F.; Cherednichenko, I. F. Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 3, 465-468(Mar 1974). (In Russian).

Samples for studying the $CaTiO_3-La_2TiO_5$ system were produced by reacting an ammonia solution of ammonium carbonate with the chlorates of calcium, lanthanum, and titanium. After washing and drying, the residues were analyzed after heating for 6 to 12 hours at different temperatures (100 to 1300°C). Results of x-ray and chemical phase analysis showed that 6 to 8 hours is sufficient for establishing equilibrium. From the constructed phase diagram it was found that a region of $CaTiO_3$-base solid solutions with a perovskite structure is formed. A new phase appears above 1100°C which could not be separated for identification but it was ascertained that this phase is a new compound with a composition close to that of $Ca_2La_2Ti_3O_{11}$. One figure, one table, 13 bibliographic references. (JPRS)

13677 PREPARATION, TESTING, AND RADIOCHEMICAL APPLICATION OF SYNTHETIC INORGANIC ION EXCHANGERS. Szirtes, L.; Zsinka, L. (MTZ Izotop Intezete, Budapest). Izotoptechnika; 17: No. 11, 545-554(Nov 1974). (In Hungarian).

Methods were described for the preparation of the phosphates of Zr, Ti, and Cr, the molybdates of Zr and Ti, and Zr tellurate. Their exchange capacity, selectivity, and radiation resistance were investigated. (auth)

Isotope Effects

Refer also to abstracts 13765 and 13769.

13678 STUDIES ON ALKYL METAL ALKOXIDES OF ALUMINUM, GALLIUM, AND INDIUM. III. Properties and Vibrational Spectra of Dialkylgallium and Indium Alkoxides. Mann, G.; Olapinski, H.; Ott, R.; Weidlein, J. (Univ., Stuttgart). Z. Anorg. Allg. Chem.; 410: No. 2, 195-205(Nov 1974). (In German).

The preparation and the properties of dialkyl metal alkoxides R_2MOR' (with R = CH_3, CD_3, C_2H_5; R' = CH_3, CD_3 and M = Ga, In) are described. The vibrational data (ir and Raman) of the trimeric methyl derivatives point to puckered six-membered M_3O_3-ring systems. (auth)

13679 DETERMINATION OF RATE CONSTANTS OF ADSORPTION AND RECOMBINATION OF HYDROGEN ATOMS ON A GOLD SURFACE. Kislyuk, M. U.; Tret'yakov, I. I. (Inst. of Chemical Physics, Moscow). Kinet. Catal. (USSR) (Engl. Transl.); 15: No. 3, 631-635(1974).

Translated from Kinet. Katal.; 15: No. 3, 710-714(1974).

Recombination of hydrogen and deuterium atoms on the surface of gold films, purified in an ultra-high vacuum, was investigated. Rate constants of elementary stages were studied in a wide temperature interval (77 to 340°K): adsorption, surface and impact recombination. The studied constants obey the Arrhenius equation and are in good agreement with the activated-complex theory. The observed kinetic isotope effects indicate that the rate of recombination of adsorbed atoms is determined by their surface mobility and the activated complexes of processes of adsorption and impact recombination of atoms do not possess translational degrees of freedom. Coefficients of recombination (γ), the maximum values of which amount to ~0.1, were calculated from values of the obtained constants. The temperature dependence has a complex character. Calculated values of γ are in good agreement with data of other authors, obtained by direct measurements. (auth)

13680 HYDROGEN ELIMINATION FROM CARBON–SILICON ION MOLECULE REACTION INTERMEDIATES. Henis, J. M. (Monsanto Co., St. Louis); Stewart, G. W.; Gaspar, P. P. J. Chem. Phys.; 61: No. 11, 4860-4862(1 Dec 1974).

A detailed analysis of the isotopic distribution of the $SiCX_4^+$ product from the reactions $SiH_2^+ + CD_4$ and $SiD_2^+ + CH_4$ shows that the product distribution is clearly nonrandom and that X_2 elimination from the silicon atom is favored by more than an order of magnitude over elimination from any other site. It is suggested that the observed selectivity may be related to the fact that silicon is the initial ionic center in both reactions studied. (auth)

13681 SUBSTITUTION REACTIONS OF OXALATO COMPLEX IONS. XI. Kinetics of the Anation of Aquopentaamminecobalt (III) Ion By Oxalate in Aqueous Acidic Solution. van Eldik, R.; Harris, G. M. (State Univ. of New York, Buffalo). Inorg. Chem.; 14: No. 1, 10-14(Jan 1975).

The title reaction has been studied in the temperature range 50 to 80°C, with the acidity range from pH 7.5 up to 1.0 M, and with oxalate concentrations between 0.04 and 0.45 M. It goes essentially to completion even at the highest acidities in the presence of excess oxalate. Ion pairing is not significant between the complex ion and $H_2C_2O_4$ but is kinetically identifiable with $HC_2O_4^-$ and $C_2O_4^{2-}$, such that the rate expression becomes as shown in eq 4. The essentially temperature-independent ion-pair formation constants for bioxalate and oxalate ions are $Q_1 = 1.8\ M^{-1}$ and $Q_2 = 9.2\ M^{-1}$, respectively. The rate constants at 70° for anation by $H_2C_2O_4$, $HC_2O_4^-$, and $C_2O_4^{2-}$ are $k_0 = 1.5 \times 10^{-4}\ M^{-1}\ sec^{-1}$, $k_1 = 4.9 \times 10^{-4}\ sec^{-1}$, and $k_2 = 4.0 \times 10^{-4}\ sec^{-1}$. The corresponding temperature parameters are $\Delta H^{\ddagger} = 14.3 \pm 1.7$, 22.4 ± 2.1, and 24.8 ± 1.8 kcal/mol, respectively, and $\Delta S^{\ddagger} = -35.0 \pm 4.8$, -8.6 ± 6.3, and -2.1 ± 5.4 cal/(deg mol), respectively. On the basis of the contrast in temperature parameters and a study of the solvent D_2O effect, it is concluded that the mechanism for $H_2C_2O_4$ addition may not be of the conventional water–ligand dissociative type which appears to be the mechanism for the two ionic oxalate species. (auth)

13682 PRIMARY ISOTOPE EFFECTS AND GENERAL BASE CATALYSIS IN THE HYDROLYSIS OF TRANS-DICHLORO(1,9-DIAMINO-3,7-DIAZANONANE)COBALT(III) CATIONS. Ahmed, E.; Tucker, M. L.; Tobe, M. L. (University Coll., London). Inorg. Chem.; 14: No. 1, 1-5(Jan 1975).

The kinetics of the base hydrolysis of trans-dichloro-(RS)- and trans-dichloro[(RR(SS))-1,9-diamino-3,7-diazanonane]cobalt(III) cations and their N-deuterated analogs have been studied in aqueous solution using sodium hydroxide or a substituted pyridine as base. For the reaction with hydroxide, $k_1^{OH} = 1.5 \times 10^4\ M^{-1}\ sec^{-1}$ at 13.5° ($\mu = 0.05$) for the RS isomer and $3.0 \times 10^4\ M^{-1}\ sec^{-1}$ for the RR(SS) isomer. In the latter case $\Delta H^{\ddagger} = 13.7$ kcal/mol and $\Delta S^{\ddagger} = +12$ cal $deg^{-1}\ mol^{-1}$. The activation parameters reflect the rate-determining character of the de-

protonation step. The primary isotope effect $k_B^{OH}(H)/k_B^{OH}(D)$ = 1.7 and 1.5 for the RR(SS) and RS isomer, respectively and is, at first sight, rather small for such a rate-determining protonation but the behavior is rationalized in terms of the structure of the transition state. General base catalysis is observed with a Bronsted coefficient, $\beta = 0.67 \pm 0.07$. (auth)

13683 EMISSION SPECTRA OF THE $P^{18}O$ MOLECULE: NEW DATA ON THE $E^2\Delta$ STATE. Prudhomme, J. C.; Coquart, B. (CNRS, Reims Cedex, France). Can. J. Phys.; 52: No. 21, 2150-2156(1 Nov 1974). (In French).

Seven bands of the $E^2\Delta - X^2\Pi_r$ system of the $P^{18}O$ molecule were analyzed rotationally under a dispersion of 0.24 Å/mm. A study of the vibrational levels 0, 1, and 2 for the $E^2\Delta$ state was carried out. The perturbations and predissociations are discussed all together for $P^{16}O$ and $P^{18}O$. The interaction between the $E^2\Delta$ and $C'^2\Delta$ states is confirmed. The molecular constants of the E state are readjusted by considering all its levels for $P^{16}O$ and $P^{18}O$. (auth)

13684 CHLORINE KINETIC ISOTOPE EFFECTS IN THE CYCLIZATION OF CHLOROALCOHOLS. Cromartie, T. H.; Swain, C. G. (Massachusetts Inst. of Tech., Cambridge). J. Amer. Chem. Soc.; 97: No. 1, 232-233(8 Jan 1975).

Studies are reported that show that the chlorine kinetic isotope effects for the base-catalyzed cyclizations of 2-chloroethanol and 4-chlorobutanol to ethylene oxide and tetrahydrofuran, respectively, in water at 25°C confirm the previously reported conclusion that this isotope effect for the hydroxide-catalyzed cyclization of 2-chloroethanol is significantly greater than that for 4-cyclobutanol. Probable mechanisms for this deviation from the Hammond postulate and the reacting bond rule are discussed. (JSR)

Isotope Exchange and Isotope Separation

Refer also to abstracts 13798 and 14084.

13685 (COO-3127-8) STUDIES OF CARBON-ISOTOPE FRACTIONATION. Progress Report, March 1, 1974-February 28, 1975. Ishida, T. (Brooklyn Coll., N. Y. (USA)). 1 Dec 1974. Contract AT(11-1)-3127. 117p. Dep. NTIS $9.00.

Progress in investigations of low-temperature distillation of fluorinated methanes and related studies is reported. A precision cryostat, to be used at temperatures >200°K, has been designed, and its construction started. Effects of temperature on the overall separation of ^{13}C in a single column apparatus were investigated for the system 1 M di-n-butylamine carbamate in triethylamine as well as in methanol. (LK)

13686 (COO-3521-53) RECENT ASPECTS OF CYCLOTRON PRODUCTION OF MEDICALLY USEFUL ISOTOPES. Gelbard, A. S.; Hara, T.; Tilbury, R. S.; Laughlin, J. S. (Sloan-Kettering Inst. for Cancer Research, New York (USA)). 1972. 13p. Dep. NTIS $4.00.

The parameters involved in the production of ^{13}NH by deuteron irradiation of methane gas were studied. The effects of methane purity, nitrogen concentration, addition of oxygen of hydrogen on the $^{13}NH_3$ yield were determined. ^{73}Se was produced by 23 MeV $^3He^{++}$ ion irradiation of solid Ge targets and chemically separated by solvent extraction. The use of $^{11}CN^-$ for blood labeling was described. (JSR)

13687 INVESTIGATION OF DEUTEROHYDROGEN EXCHANGE OF CYCLIC HYDROCARBONS ON METALLIC CATALYSTS COMMUNICATION. II. Kinetic Analysis of the Reaction of Deuterohydrogen Exchange of Cyclohexane on a Nickel Catalyst. Nekrasov, N. V.; Gudkov, B. S.; Kiperman, S. L. (Inst. of Organic Chemistry, Kazan). Bull. Acad. Sci., USSR, Div. Chem. Sci. (Engl. Transl.); 23: No. 6, 1189-1194(Jun 1974).

Translated from Izv. Akad. Nauk SSSR, Ser. Khim.; 23: No. 6, 1262-1268(Jun 1974).

A probability method of calculation of the initial rates of formation of products of deutero exchange of hydrocarbons, containing equivalent hydrogen atoms, according to the experimentally found concentrations and rates of accumulation of the products at later stages of the reaction, was proposed. This method also permits the solution of the reverse problem of calculation of the concentrations, as well as the rates of formation and consumption of all the deuteroproducts at any moment of time, on the basis of the initial rates of their formation. From the results of the kinetic analysis it follows that all 12 possible deuterocyclohexanes are primary products of the exchange of C_6H_{12} and D_2. A kinetic equation describing the dependence of the rates of isotopic exchange of cyclohexane and the rates of formation of deuteroproducts on the initial concentrations of cyclohexane and deuterium was proposed. (auth)

13688 HYDROGEN ISOTOPE EXCHANGE UNDER THE INFLUENCE OF THE CATALYTIC SYSTEM $(\pi-C_3H_5NiBr)_2 + TiCl_4$. Borisova, N. A.; Mushina, E. A.; Smirnova, R. S.; Fridman, R. A.; Krentsel, B. A. (Inst. of Petrochemical Synthesis, Moscow). Bull. Acad. Sci., USSR, Div. Chem. Sci. (Engl. Transl.); 23: No. 6, 1330-1331(Jun 1974).

Translated from Izv. Akad. Nauk SSSR, Ser. Khim.; 23: No. 6, 1409-1411(Jun 1974).

It was established that isotope exchange takes place during the copolymerization of ethylene with propylene under the influence of the catalytic system based on $(\pi-C_3H_5NiBr)_2$. It was shown that the kinetic isotope effect is absent. (auth)

13689 INFLUENCE OF THE NATURE OF THE SUBSTITUENT ON H-D EXCHANGE CATALYZED BY Pt(II) IN CERTAIN FUNCTIONAL DERIVATIVES OF METHANE AND ETHANE. Repka, L. F.; Shteinman, A. A. (Inst. of Chemical Physics, Chernogolovka, USSR). Kinet. Catal. (USSR) (Engl. Transl.); 15: No. 3, 722-725(1974).

Translated from Kinet. Katal.; 15: No. 3, 805-808(1974).

It was found that the logarithms of the rate constants of the deuteroexchange of substituted methanes and ethanes, catalyzed by Pt(II), are satisfactorily correlated with the two-parameter equation $\lg(\kappa/\kappa_0) = \rho^*\sigma^* + n\psi$. (auth)

13690 ISOTOPIC EXCHANGE OF OXYGEN IN SOLID SOLUTIONS WITH THE FORMULA $Li_xNi_{1-x}O$. Semin, G. L.; Cherkashin, A. E.; Keier, N. P.; Koshcheev, B. V.; Berinskii, V. Yu. (Catalysis Inst., Novosibirsk, USSR). Kinet. Catal. (USSR) (Engl. Transl.); 15: No. 3, 604-609(1974).

Translated from Kinet. Katal.; 15: No. 3, 681-686(1974).

A study was made of the homomolecular and hetero-exchange of oxygen in solid solutions with the formula $Li_xNi_{1-x}O$, containing from 0.2 to 4.2 at. % lithium. Introduction of lithium into the lattice of NiO leads to a lowering of the activation energy of both homomolecular and hetero-exchange by 6 to 9 kcal/mole compared to pure NiO. Hetero-exchange in solid solutions with the formula $Li_xNi_{1-x}O$ takes place, as in pure NiO, mainly by a mechanism that includes the replacement of two atoms of surface oxygen by a molecule from the gas phase. The presence of lithium oxide on the surface of $Li_xNi_{1-x}O$ appreciably decreases the rate of isotopic exchange, but practically does not change the activation energy. The change in the activation energy of hetero-exchange in a number of compounds with the formula $NiO-Li_xNi_{1-x}O$ and the change in the position of the Fermi level with respect to the top of the 3d-zone in these compounds are connected by a linear dependence. (auth)

13691 LIQUID-VAPOR SEPARATION FACTOR OF DILUTE SOLUTIONS OF DTO IN D_2O. Zel'venskii, Ya. D.; Kovalenko, A. E.; Timashev, A. P.; Egurnov, V. Ya. Sov. At. Energy (Engl. Transl.); 36: No. 5, 501-503(May 1974).

Translated from At. Energ.; 36: No. 5, 396-397(May 1974).

In this article, which is a continuation of previous measurements of the liquid-vapor separation factor of dilute solutions of HTO in H_2O, results of an experimental determination of the separation factor of hydrogen isotopes in rectification of dilute solutions of DTO in D_2O at 50-100°C are described. (auth)

13692 HYDROGEN-DEUTERIUM EXCHANGE OF SUBTILISIN TYPE CARLSBERG AND SUBTILISIN TYPE NOVO. Johansen, J. T.; Ottesen, M. (Carlsberg Lab., Copenhagen). Israel J. Chem.; 12: No. 1-2, 339-349(1974).

The hydrogen-deuterium exchange of diisopropyl phosphate-inhibited subtilisin (DIP-subtilisin) Carlsberg type and DIP-subtilisin Novo type was measured in the pD interval 2 to 8. In the pD range 4.5 to 8 the native DIP-subtilisins demonstrated closely related exchange properties, especially with respect to the more slowly exchanging fractions of the peptide hydrogens, and this is taken as support for the hypothesis that the two subtilisin molecules have the same internal folding of the peptide chains. The subtilisins exhibit slower exchange rates than any other proteins thus far investigated. The acid denaturation of subtilisin Carlsberg from pD 2-4 is accompanied by the formation of β-structure. A similar transformation was not observed with subtilisin Novo. (auth)

13693 STUDIES OF THE HYDROGEN EXCHANGE IN AQUEOUS SOLUTIONS OF POLY-N^5-(3-HYDROXYPROPYL)-L-GLUTAMINE. Hvidt, A. (Univ., Copenhagen). Israel J. Chem.; 12: No. 1-2, 179-188(1974).

The H-D exchange of the peptide groups of poly-N^5-(3-hydroxypropyl)-L-glutamine (PHPG) in D_2O solution was studied by an infrared spectrophotometric method. The exchange of the peptide groups of the side chains of the polymer follows simple first-order kinetics, with exchange rates 3-4 times slower than those of N-methylacetamide. The kinetics of the exchange of the peptide groups of the polypeptide chain is more complicated and suggests that these molecules are less motile than other polypeptides stud-

ied by the exchange method. The observation that the exchange rates measured in solutions of PHPG, as a whole, are much faster than the exchange rates typical of protein solutions is taken as experimental evidence of the shortcoming of PHPG as a model of a protein molecule. (auth)

13694 THE KINETICS OF THE ISOTOPIC EXCHANGE OF P AND Ca IN ROCK PHOSPHATE. Kotze, W. A. G.; Deist, J. (Fruit and Food Technology Research Inst., Stellenbosch (South Africa)). Agrochemophysica; 5: 57-60(12 Jan 1973).

9 refs.

Since isotopic exchange is a first order reaction a rectilinear relationship is expected to exist between the logarithm of the number of ions exchanged and time. However, with isotopic exchange in rock phosphate such a relationship is generally not found. Rock phosphate samples of 15 g each were suspended in 1.5 of a 0.01 N KCl + 0.01 N acetic acid-acetate buffer solution (pH 450) in a 2 1 flask in a temperature controlled waterbath (30°C). The rock phosphates used were the commercially available Reno (North Africa) Senegal (West Africa) and Langfos (South Africa). In the case of phosphate exchange a Senegal rock phosphate and calcium exchange in Reno rock phosphate, two straight lines were found, suggesting that at least two diffusion processes were taking place simultaneously. Both phosphate and calcium self-diffusion coefficient placed these rock phosphates in the order Reno > Langfos > Senegal which is the same as the order of their availability found in pot experiments. (INIS)

13695 RAPID OXYGEN EXCHANGE BETWEEN $[Mo(O)(OH)(CN)_4]^{1-}$ AND WATER. Murmann, R. K.; Robinson, P. R. (Univ. of Missouri, Columbia). Inorg. Chem.; 14: No. 1, 203-205(Jan 1975).

There has been confusion about the composition and structure of the species present in solution when $K_4[Mo(O)_2(CN)_4]$ is dissolved in water. An attempt was made to use ^{18}O measurements to obtain information about the coordination number of these substances in solution and to study the kinetics of isotopic oxygen exchange as a function of solution composition, but the isotopic water exchange under obtainable conditions is too rapid to allow structural or kinetic information to be obtained. (LK)

Feed Materials Processing

Refer also to abstracts 13773, 13807, and 14016.

13696 (BARC/I-264) RADIATION SAFETY MANUAL FOR ALWAYE PLANT, INDIAN RARE EARTHS LTD. Paul, A. C.; Ramachandran, V. (Bhabha Atomic Research Centre, Bombay (India)). 1973. 30p. INIS.

Radiological health hazards in the processing of monazite at Alwaye Plant, India, are discussed. Safety standards are enunciated to control and minimize the health hazards during the course of work inside the plant. (INIS)

13697 (CEA-Bib-212(1)) SOLVENT EXTRACTION OF ZINC AND METALS FROM THEIR ORE BY ORGANO-PHOSPHORUS COMPOUNDS. Auchapt, J. M.; Tostain, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91—Gif-sur-Yvette (France). Service de Documentation; CEA Centre de Production de Plutonium de Marcoule, 30—Bagnols-sur-Ceze (France)). Oct 1974. 71p. (In French). Dep. NTIS (US Sales Only) $6.75.

All the methods of solvent extraction of Zn, Cd, Pb, Ag, and Ge are reviewed. They are limited to organo-phosphorus compounds. They include industrial processes and those which could become such, as much as analytical processes or those which are issued from pure or applied research. These differences do not appear clearly in the text, the classification of which being made from chemical constitution of the solvents, some of them uncommon laboratory products. (94 references) (auth)

13698 (IEA-341) DETERMINATION OF THE CONCENTRATION OF UO_2F_2, UO_2, AND UF_4 IN URANIUM TETRAFLUORIDE. Federgruen, L.; Abrao, A. (Instituto de Energia Atomica, Sao Paulo (Brazil)). May 1974. 16p. (In Portuguese). Dep. NTIS (US Sales Only) $4.00.

A procedure is outlined for the analytical control of uranium tetrafluoride preparations. The procedure allows the sequential analysis of the most probable products existing along with UF_4. First, UO_2F_2 is extracted with ethanol and filtered into a glass porous plate. The residual mass ($UF_4 + UO_2$) in the filter disc is directly treated with hot ammonium oxalate solution and then filtered. The UF_4 content is determined in the ammonium oxalate filtrate solution. The final residue is analyzed for the insolubles in ammonium oxalate, which corresponds practically to the unconverted UO_2. The method is simple, convenient, precise, and accurate. Duplicate samples can be analyzed in approximately 6 hours. (auth)

13699 (INIS-mf-1329) ION-EXCHANGE PILOT PLANT FOR THE PREPARATION OF NUCLEAR PURE URANIUM COMPOUNDS. Abrao, A.; Franca, J. M. Jr.; de Araujo, J. A.; Cussiol Filho, A.; Ribas, A. G. S.; Gochnarg, I. (Instituto de Energia Atomica, Sao Paulo (Brazil). Divisao de Engenharia Quimica). [nd]. 8p. INIS.

The installation and operation of a pilot plant for uranium purification based on an ion exchange process is described. The preparation of uranyl nitrate solution used to feed the ion exchange columns is performed by fractional dissolution of raw sodium diuranate. The decontamination of thorium plus rare earth elements is achieved by oxalic acid precipitation directly in the bulk of uranyl nitrate. The decontamination of various impurities is enhanced by an EDTA complex formation before the uranyl nitrate solution is loaded onto the strong cationic resin bed. The uranyl sulfate obtained by eluting the resin column with ammonium sulfate is reverse precipitated to avoid sulfate coprecipitation in the nuclear grade ammonium diuranate obtained. (INIS)

13700 SINTERING OF SOL-GEL MATERIAL. Bruijn, E. J.; Hamburg, F. W.; Kanij, J. B. W.; de Rooy, R. (to Reactor Centrum Nederland). US Patent 3,846,520. 5 Nov. 1974. Priority Date 17 May 1971, Netherlands. 6p.

An economic method is described for sintering spherical so-gel material. Spherical hexavalent oxidic uranium material, such as A.D.U. or UO_3-hydrate, is converted into nuclear fuel of high density by means of a sinter stage, which consists in heating up and cooling at a rate of 10°-65° C/min. The sinter stage may be preceded by a preheating stage, and the starting material may contain finely divided carbon. Previously only spherical sol-gel material of tetravalent uranium and pressed compacts of ceramic uranium dioxide powder were sintered with the above heating rates. Tetravalent uranium material has disadvantages with respect to hexavalent uranium material. (Official Gazette)

13701 HEAT TREATMENT OF URANYL XEROGEL PREPARED BY THE SOL-GEL METHOD. Landspersky, H. Nukleon; No. 4, 22-27(Dec 1973). (In Czech).

Thermal decomposition of ammonium polyuranate xerogel prepared by the sol-gel method under air at temperatures of up to 450°C and the direct reduction of this xerogel under an Ar + 5% H_2 mixture were studied. No significant difference was found between the decomposition of xerogels and that of powdered materials under air; in both cases, the decomposition proceeded in two steps, the first one affecting considerably the quality of the final product, sintered UO_2. The direct reduction proceeded in three steps; considerable differences were observed in temperatures; they depended on the initial material. The reduction started at low temperatures (260 to 280°C) before the hydration to UO_3 had been completed. The activation energy of these processes was determined and compared with the values obtained for powdered materials. (auth)

13702 REDUCTION OF U_3O_8 POWDER BY MOLTEN ALUMINUM. de Souza Santos, T. D. (Instituto de Energia Atomica, Sao Paulo (Brazil). Divisao de Metalurgia Nuclear). Metalurgia (Sao Paulo); 26: No. 149, 283-288(Apr 1970). (In Portuguese).

From 24th annual meeting of the Brazilian Association of Metals; Sao Paulo, Brazil (Jul 1969).

Experimental studies, carried out at the Divisão de Metalurgia Nuclear, concerning the reduction of U_3O_8, as a loose powder, with molten aluminum or aluminum-uranium alloy, under the protection of a bath of cryolite are described. The influence of the principal variables affecting the reduction was studied, in view of both high uranium contents in the alloy and high recoveries. The experiments were carried out in an assembly mounted by the author and consisting essentially of an induction-heated graphite crucible, which could be easily taken out from the coil to pour its molten contents. Power was supplied by a high frequency (1 MHz) generator. The data obtained in seven series of experiments totalling 36 runs show that with 15 minutes of total operating time, alloys up to 57.7% U were obtained, with recoveries between 90 and 98%. (INIS)

13703 U_3O_8 FLUORINATION SYSTEM (4 JAN 1974) (ENGINEERING MATERIALS). (National Lead Co. of Ohio, Cincinnati (USA)). (CAPE-2392).

27 drawings.

The U_3O_8 fluorination system can be worked in the auto or manual mode. The step-by-step procedure for the operation of the system is given. (JSR)

Radiation Chemistry

Refer also to abstracts 13766, 14270, 14275, 14703, 15009, 15476, and 15568.

13704 (AAEC/E-320) CONCRETE–POLYMER COMPOSITE MATERIALS PRODUCED BY RADIATION POLYMERIZATION TECHNIQUES. McLaren, K. G.; Samarin, A. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Jul 1974. 40p. Dep. NTIS (US Sales Only) $5.00.

Exploratory studies have been carried out on the production and properties of concrete-polymer composite materials, made by impregnating precast concrete with monomers and polymerizing the monomer in situ with gamma radiation. The composites have much greater compressive and tensile strengths, and higher elastic moduli than the original concrete. The main factor influencing the degree of enhancement of these properties is the total polymer loading in the interstices of the concrete, and the ultimate strength attainable in the composites is largely independent of the type of concrete used to make the composite. With polymethyl methacrylate composites, compressive strengths up to 117 MPa, Brazil tensile strengths up to 8.95 MPa, and elastic moduli up to 3.75×10^4 MPa were obtained with polymer loadings around 4.7%. Composites made from porous concrete (Besser brick) and polyester resins had compressive strengths around 145 MPa. Because of the inherently low thermal stability of the polymer component, composites for structural purposes would be restricted to applications where they would not be exposed to fire. Uses envisaged for these new types of material include drain piping in corrosive environments, underwater structures, bridge decking and decorative panelling. Polymerization can be accomplished by thermal means as well as by radiation, and the method of choice for a given application will depend largely on relative costs. Certain types of mineral aggregate are not suitable for concrete which is to be converted to concrete-polymer composites, as their use leads to severe cracking problems. This aspect requires further work. (auth)

13705 (AEC-tr-7422/8) NUKLEONIKA. Translated From Nukleonika; 18: No. 9, 333-382(1973). 48p. Dep. NTIS $4.00.

13706 (CEA-R-4638) INTERLABORATORY TESTS ON IONIZING RADIATION METROLOGY ORGANIZED BY THE L.M.R.I. IN 1972. Perolat, J. P.; Capgras, A.; Morel, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91–Gif-sur-Yvette (France). Div. de Chimie). Dec 1974. 43p. (In French). Dep. NTIS (US Sales Only) $5.25.

Seven interlaboratory tests were organized on a national level by the L.M.R.I. in 1972; 5 of them concerning radioactivity measurements of ^{125}I, ^{99m}Tc, ^{113}Sn, ^{197}Hg, and ^{131}I solutions, a radioanalysis test of a mixture of ^{56}Co, ^{57}Co, ^{58}Co, and ^{60}Co, and a test of ^{241}Am–Be neutron source measurement. 24 laboratories, most of them not being specialists in radioactivity measurements, have participated in these tests. The results are satisfactory for ^{115}I, ^{99m}Tc, ^{131}I, and radioanalysis tests, but not for ^{197}Hg, ^{113}Sn, and the neutron source measurement. Reasons are given and suggestions are made to improve the accuracy in these last cases. (auth)

13707 (COO-958-50) PROPERTIES OF SOLVATED ELECTRONS AND ASSOCIATED SPECIES IN METAL SOLUTIONS AND KINETICS OF ELECTRON- AND PROTON-TRANSFER REACTIONS. Progress Report, September 16, 1973–September 15, 1974. Dye, J. L. (Michigan State Univ., East Lansing (USA). Dept. of Chemistry). 1974. Contract AT(11-1)-958. 11p. Dep. NTIS $4.00.

By using a macrobicyclic polyoxa diamine (2, 2, 2 cryptand) to complex alkali cations, a salt of the sodium anion, Na^- was prepared and characterized (by x-ray structure determination). Studies of solutions of this salt in ethylamine and in tetrahydrofuran by ^{23}Na NMR techniques show that the anion is probably a spherically symmetric species with two electrons in the 3s orbital. The rate of exchange of solvated Na^+ and cryptated Na^+ in a number of solvents was measured by ^{23}Na NMR methods. A computerized rapid-scanning stopped-flow system was used to measure the rate of protonation of potassium anthracenide. Crown and cryptand complexing agents were used to determine the role of ion-clustering and dianion formation in the protonation reaction. (auth)

13708 (INIS-mf-1271) PRELIMINARY STUDIES OF GRAFT COPOLYMERIZATION OF METHYL METHACRYLATE IN HENEQUEN BY HIGH ENERGY ELECTRON IRRADIATION. Uribe R, R. M. (Universidad Nacional Autonoma de Mexico, Mexico City. Facultad de Ciencias). 1973. 127p. (In Spanish). INIS.

Thesis.

The possible formation of graft copolymer of methyl methacrylate in henequen fibers is discussed. The theory of radiation-induced polymerization is presented. The use of films of polyvinyl chloride as a secondary dosimeter for the irradiation of henequen is discussed. The design of the irradiation installation and its calibration is discussed. Since henequen is formed principally of cellulose, the results obtained are compared with those obtained by others in the irradiation of cellulose and methyl methacrylate–methanol. (tr-auth)

13709 (INS–764, pp 34-37) REACTIONS OF THE HYDROPEROXY RADICAL ($HO_2\cdot$) WITH NITROGEN DIOXIDE (NO_2). Sutton, H. C.; Dodson, C. R. Apr 1974.

13710 (INS–764, pp 38-40) ELECTROCHEMISTRY OF THE SUPEROXIDE RADICAL ION ($O_2^-\cdot$). Sutton, H. C.; Dodson, C. R. Apr 1974.

13711 (JAERI-M-5485) DOSE RATE DISTRIBUTION IN THE CENTRAL-SOURCE TYPE WET-WALL REACTOR OF RADIATION ETHYLENE POLYMERIZATION PILOT PLANT PICW. Nakajima, H.; Yagi, T.; Maruyama, S. (Japan Atomic Energy Research Inst., Tokyo). Dec 1973. 21p. (In Japanese). INIS.

The dose rate and its distribution were measured in the 50-liter, central-source type wet-wall reactor of radiation ethylene polymerization pilot plant-PICW in the presence of air, water and aqueous solution of t-butanol, and the values were compared with those by calculation. The 300-mm-diam by 700-mm-high polymerization reactor has an inner cylindrical casing of outside diameter 96 mm in which a cylindrical source is inserted. Three different ^{60}Co gamma sources (3,840, 7,680 and 11, 760 Ci) were used. (1) The dose rate decreases exponentially in radial directions; the value at the outer surface is $\frac{1}{3}$ that at the inner surface of the reactor. (2) The dose rate along the axis is highest in the middle, and decreases toward the ends. The closer to the source the flatter the distribution becomes. (3) The mean absorbed dose rates in the presence of t-butanol aqueous solution are 0.5×10^5, 1.1×10^5, and 1.9×10^5 rad/hr for the three sources mentioned, respectively. With the existence of a scraper, the dose rate is reduced by 10%. (4) The utilization efficiency of radiation energy is 3%. (5) The calculated dose rate is a little larger than that measured, but the dose rate distribution calculated is similar to that measured. (auth)

13712 (JAERI-M-5524) PHYSICAL PROPERTIES OF THE POWDER POLYETHYLENE PRODUCED BY RADIATION-INDUCED POLYMERIZATION. Yamaguchi, K.; Takehisa, M. (Japan Atomic Energy Research Inst., Tokyo). Jan 1974. 32p. (In Japanese). INIS.

Radiation-polymerized polyethylene "Takathene" is a fine powder with large specific surface area. Its properties were observed in comparison with conventional powdered polyethylene. The size and shape of Takathene particles vary with polymerization process and its conditions such as temperature and pressure. Takathene produced in the pilot plant of wet-wall, for example, is 8–20 μ in particle size, depending on the method of removing solvent from the slurry. Adsorption of hydrocarbon materials onto Takathene is found to be multilayer physical adsorption. The uptake by adsorption increases with its specific surface area. The heat of adsorption is about 5–6 kcal/mol at nearly 100% surface coverage. Takathene has large adsorption capacity for nonpolar organic materials, also with good desorption. In powder Takathene compact bed, the apparent density is smaller and adhesiveness of the powder layer larger than the conventional polyethylene. Pore sizes of the sintered Takathene powder compact bed are below 0.1 μ. The electrification of Takathene in mechanical friction is high in powder, but nearly the same in molding as the conventional one, possibly due to in particle size and shape. (auth)

13713 (LF-53) RELATIVE CONCENTRATIONS AND RELAXATION PROPERTIES OF ISOMERIC ALKYL RADICALS IN γ-IRRADIATED N-ALKANE SINGLE CRYSTALS. Gillbro, T.; Lund, A. (Forskningsraadens Lab., Studsvik (Sweden)). 1974. 23p. INIS.

The relative concentrations of alkyl radicals $CH_3\dot{C}HCH_2R$(I) and $R'CH_2\dot{C}HCH_2R''$ (II) were measured at low microwave power in some n-alkane single crystals γ-irradiated at 77°K to a dose of 1 Mrad. The relative concentration of radical (II) increased as the number of carbon atoms became larger. The amount of radical (I) was in agreement with a mechanism where all C–H bonds in a n-alkane molecule are ruptured with the same probability followed by an isomerization of primary alkyl radicals to radical (I). In n-decane for instance this mechanism predicts 45.5% of radical (I) compared to the experimental value of 42.5%. Saturation measurements of radical (I) and radical (II) under slow passage condition showed that the spin-lattice relaxation time T_1 is shorter for radical (I) (ca. 3×10^{-4}s) than for radical (II) (ca. 80×10^{-4}s), while the spin-spin relaxation times T_2 are similar (ca. 2×10^{-5}s). The relatively short relaxation time T_1 in radical (I) is thought to originate from higher mobility of the end of the alkane chain, where the unpaired electron is localized, combined with a modulation of the hyperfine coupling from the protons in the nearby rotating methyl group. The broad line width in irradiated protiated crystals was by comparison with results from deuterated

matrices concluded to depend on slightly distorted radicals in damaged regions (spurs, short tracks, blobs) and not on electron dipole-dipole interactions. Unresolved γ proton couplings in radical (I) are thought to cause the spin-flip transitions at high microwave power. (INIS)

13714 (RRL-3238-495) QUARTERLY REPORT, JULY 1, 1974-SEPTEMBER 30, 1974. (Mellon Inst. of Science, Pittsburgh (USA). Radiation Research Labs.). 4 Oct 1974. Contract AT(11-1)-3238. 21p. Dep. NTIS $4.25.

Titles of the reports issued during the quarter are: ESR Evidence Regarding the Structure of Some Simple Nitrogen-Centered Radicals in Aqueous Solution; Hydroxyl Radical Induced Oxidation of Nitrobenzene; Dissociation of Hydroxyl Protons of β-Hydroxyalkyl Radicals as Studied by Electron Spin Resonance; ESR Study of the Sulfide Radical Adducts to Unsaturated Compounds; Behavior of Hydrated Electrons in CTAB Micellar Solution; Quenching of Aromatic Hydrocarbon Fluorescence by Cesium Chloride; and Application of Radiation Techniques to Physical Organic Chemistry. Other investigations in progress include: alkoxy and other radicals produced from alcohols as studied by spin trapping; ESR studies of the effects of carboxylation on the electron distribution in cyclohexadienyl and hydroxycyclohexadienyl radicals; rate constants for reaction of O^- radicals with aromatic compounds; pulse radiolytic study of single-electron redox potentials; reactivity of $\cdot SO_4^-$ radical anion with pyrimidines; optical pulse radiolytic studies on aqueous solutions of glycerol and β-glycerophosphate; hydroxylation of benzoic acid; reactions of e^-_{aq} with nitrobenzyl halides in aqueous solution; pulse radiolysis studies on Vitamin K and micellar solutions; and pulse radiolysis studies on folic acid. (LK)

13715 SWELLING OF IRRADIATED POLYAMIDE FIBERS IN AQUEOUS PHENOL SOLUTIONS. Chalykh, A. E.; Goryaev, V. M.; Plavnik, G. M.; Ryabchikova, G. G.; Spitsyn, V. I. (Inst of Physical Chemistry, Moscow). Vysokomol. Soedin., Ser. A; 16: No. 11, 2554-2559(Nov 1974). (In Russian).

Data from experiments on swelling in phenol solutions and shrinkage of γ-irradiated polyamide fibers and direct structure studies showed that irradiation is accompanied by destruction of the crystalline components of the fibers, a decrease in the orientation of the macromolecular chains, and formation of joined polymer structures. (tr-auth)

13716 TUNNEL MECHANISM FOR THE RADIOLUMINESCENCE OF ORGANIC SUBSTANCES AT 77°K. The Competing Reactions of Electron Recombination and Their Capture by an Acceptor. Berlin, Yu. A.; Kulakov, V. V.; Nikol'skii, V. G. (Inst. of Chemical Physics, Moscow). Dokl. Phys. Chem.; 215: No. 4-6, 343-346(Apr 1974).

Translated from Dokl. Akad. Nauk SSSR; 215: No. 4, 887-890 (Apr 1974).

A model is proposed describing the kinetics of the long-lived component of the radiophotoluminescence of organic substances at 77°K. It is based on concepts involving a tunneling mechanism for charge transfer. An expression for the rate of recombination is derived. The radiophotoluminescence of methylcyclohexane, irradiated with γ rays at 77°K, was studied in order to validate the model. Satisfactory agreement between the results of calculations based on the model developed and experimental results were obtained. Kinetic plots of the radiophotoluminescence at various concentrations of free radicals in the system illustrate the good agreement between theoretical and experimental values. (JSR)

13717 RADIATION-INDUCED POLYMERIZATION OF ACRYLAMIDE IN AQUEOUS SOLUTION USING A ^{85}Kr SOURCE. II. Ootsuka, N.; Yamamoto, T. (Japan Atomic Energy Research Inst., Takasaki, Japan). Oyo Butsuri; 43: No. 6, 588-593(Jun 1974). (In Japanese).

The polymerization of acrylamide in aqueous solution was carried out with β-irradiation facilities using unsealed ^{85}Kr gas as an internal radiation source. The effects of various factors on the degree of polymerization, as well as the molecular weight distribution were studied. The experimental results are compared with the results using γ rays from a ^{137}Cs source. Some of the results obtained are as follows. The degree of polymerization, for either source, is inversely as the 0.27th power of dose rate and proportional to the 1st power of monomer concentration. In addition, the temperature dependence of the degree of polymerization shows a similar tendency. On the other hand, for the molecular weight distribution, a slight difference is observed. (auth)

13718 CRYSTALLIZATION OF POLYCHLOROTRIFLUOROETHYLENE AND POLYTETRAFLUOROETHYLENE. Okui, N. (Tokyo Inst. of Tech.); Kawai, T.; Kuriyama, I. Kobunshi Ronbunshu; 31: No. 6, 383-390(Jun 1974). (In Japanese).

The effects of the chain flexibility and the chain mobility on the chain folding crystallization were studied as a function of molecular weight on polychlorotrifluoroethylene (I) and polytetrafluoroethylene (II), degradated by γ rays, through use of differential scanning calorimetry (DSC) and electron microscopy. The samples used were the original sample crystallized during polymerization, those irradiated up to various doses, and those crystallized from the melt after the irradiation. It was revealed that I with rather poor flexibility gave rise to bundle-like crystals (BLC) with low crystallinity as polymerized and when crystallized from the melt, it gave chain-folded lamellar crystals (FCC) except the comparatively low molecular weight materials, which gave extended chain crystals (ECC). More rigid molecules of II gave almost ECC with high crystallinity as crystallized during polymerization, and when crystallized from the melt, it gave BLC, very long in the molecular direction but of low crystallinity except comparatively low molecular weight materials, which gave ECC. When the molecular weight decreases, a critical molecular weight region seems to exist, where the transition occurs from FCC to ECC in the case of crystallization of I from melt and that from BLC to ECC in the case of II. (auth)

13719 ELECTRON MOBILITIES AND RANGES IN SOLID NEOPENTANE: EFFECT OF LIQUID-SOLID PHASE CHANGE. Shinsaka, K.; Freeman, G. R. (Univ. of Alberta, Edmonton). Can. J. Chem.; 52: No. 20, 3556-3559(15 Oct 1974).

The mobility of thermal electrons, the radiolysis free ion yield, and the penetration range of epithermal electrons in neopentane increase on going from the liquid to the solid phase at the triple point (257°K). The mobility is u = 71 cm^2/V sec in the liquid at 258°K and 154 cm^2/V sec in the solid at 257°K; the density normalized penetration range of the secondary electrons in x radiolysis is $b_{GPd} = 1.25 \times 10^{-6}$ g/cm^2 in the solid (253 to 202°K). The increases at the triple point are presumably due to the greater degree of order in the solid. Electron mobility in the solid increases with decreasing temperature, u(solid) ≈ $6.8 \times 10^5 T^{-5}$ cm^2/V sec. The scattering length of neopentane is ~8Å in the solid and ~9Å in the liquid near the triple point. (auth)

13720 EPITHERMAL ELECTRON RANGES AND THERMAL ELECTRON MOBILITIES IN LIQUID AROMATIC HYDROCARBONS. Shinsaka, K.; Freeman, G. R. (Univ. of Alberta, Edmonton). Can. J. Chem.; 52: No. 20, 3495-3506(15 Oct 1974).

Radiolysis free ion yields were measured as functions of electric field strength and temperature in benzene, toluene, 1,2-,1,3-, and 1,4-dimethylbenzene, 1,2,3-, 1,2,4-, and 1,3,5-trimethylbenzene, 1,2,3,4- and 1,2,4,5-tetramethylbenzene, pentamethylbenzene, hexamethylbenzene, naphthalene, and anthracene. Secondary electron ranges b_{GP} were estimated from the yields. The density-normalized ranges b_{GP} d were almost constant, 34 to 38×10^{-8} g/cm^2, from benzene up to the tetramethylbenzenes, then increased to 47×10^{-8} in pentamethyl- and 52×10^{-8} in hexamethylbenzene. In naphthalene and anthracene the normalized ranges were 32 and ~20×10^{-8} g/cm^2, respectively. Electron mobilities in the liquids at 293°K, and their activation energies, expressed in (cm^2/V sec, kcal/mol) were: benzene (0.114, 7.4); toluene (0.063, 3.4), 1,2-dimethylbenzene (0.018, 4.4); 1,3-dimethylbenzene (0.057, 4.5); 1,4-dimethylbenzene (0.062,-); 1,2,3-trimethylbenzene (0.022, 4.8); 1,2,4-trimethylbenzene (0.035, 4.3); 1,3,5-trimethylbenzene (0.17, 3.2); 1,2,3,4-tetramethylbenzene (~0.02, 5). The mobilities reflect migration retarding influences of the aromatic ring and molecular asymmetry, and a slight ring-shielding effect of methyl groups that tends to enhance the mobility. (auth)

13721 RADIOLYSIS OF ETHANE + SULFUR HEXAFLUORIDE AND ETHYLENE + SULFUR HEXAFLUORIDE GASEOUS SYSTEMS. Formation of SF_5 Radical and Its Reactivity. Gawlowski, J.; Herman, J. A. (Univ. of Laval, Quebec). Can. J. Chem.; 52: No. 21, 3631-3636(1 Nov 1974).

Neutralization processes of ions in radiolysis of ethane or ethylene + sulfur hexafluoride systems lead to the formation of the SF_5 radical. Compounds of the general formula RSF_5 are formed as a result of recombination reactions with hydrocarbon radicals. In the mixture ethane + 0.3% sulfur hexafluoride the radiochemical yield of SF_5 is $G_{SF_5} = 2.8 \pm 1$. The presence of ammonia decreases G_{SF_5} to ca. 0.2, suggesting that the neutralization process of the ion $NH_4^+(NH_3)_7$ with SF_6^- ions follows some unknown path. In the present work some reactions of the SF_5 radical are studied. Preliminary results indicate that the presence of SF_6 influences very little, if at all, the yield of atomic hydrogen. (auth)

13722 CHARACTERIZATION OF SECONDARY RADICAL REACTIONS IN IRRADIATED RIBONUCLEASE. Copeland, E. S. (Walter Reed Army Inst. of Research, Washington, DC). Radiat. Res.; 61: No. 1, 63-79(Jan 1975).

Solid ribonuclease (RNase) was irradiated in vacuum at 196°K and subsequently heated. The kinetics of formation of secondary

radicals were studied by following the growth of these radicals at different temperatures. Progressive power saturation studies were applied to determine $(T_1T_2)^{\frac{1}{2}}$ for primary and secondary radicals. The carbon radicals formed during irradiation at 196°K have $(T_1T_2)^{\frac{1}{2}}$ equal to 1.0 μsec at 77°K and the corresponding value for secondary carbon radicals at the same temperature is approximately the same. Evidence is presented that suggests that the primary organosulfur radicals relax at a faster rate than primary carbon radicals but slower than secondary neutral organosulfur radicals that have $(T_1T_2)^{\frac{1}{2}}$ equal to 0.18 μsec. Two statistically significantly different activation energies were measured for the formation of both secondary sulfur and carbon doublet radicals, approximately 4 and 8 and 9 and 18 kcal/mole for the organosulfur and doublet radicals, respectively. Data are presented that indicate that the secondary carbon radical population is complex and probably consists of species producing both doublet and triplet spectra. Such data are consistent with carbon radicals on residues such as methionine and lysine in addition to glycine. (auth)

13723 ESR SINGLE CRYSTAL STUDY OF THE MECHANISM OF FREE RADICAL FORMATION IN NITROMETHYL PYRIMIDINES. Lorenz, P.; Benson, B. (LeHigh Univ., Bethlehem, PA). Radiat. Res.; 61: No. 1, 36-46(Jan 1975).

1-Methyl-5-nitrouracil, 3-methyl-5-nitrouracil, and 1,3-dimethyl-5-nitrouracil form iminoxy radicals R=N-Ȯ when exposed to ionizing radiation as do most other nitropyrimidines. The nitrogen hyperfine coupling principal values for this radical in 1-methyl-5-nitrouracil are A_1 = 49G, A_2 = 29G, and A_3 = 25G; the g-value principal values are g_x = 2.0067, g_y = 2.0059, g_z = 2.0020. Additional couplings seen at a few orientations allowed identification of the complete radical structure. The mechanism postulated for nitropyrimidine radical formation involves a hydrogen addition to a nitro-group oxygen, followed by the transfer of this OH group to C(6) of the pyrimidine ring. The alkyl group on C(6) in 5-nitro-6-methyluracil and 5-nitro-6-ethyluracil prevents the second step and noniminoxy radicals are subsequently formed. (auth)

13724 PHOTOIONIZATION SPECTRUM OF SOLVATED ELECTRONS. Aulich, H.; Nemec, L.; Delahay, P. (New York Univ.). J. Chem. Phys.; 61: No. 10, 4235-4241(15 Nov 1974).

Photoionization cross sections are reported for solvated electrons at photon energies from 1.2-4.1 eV and the sodium species Na^- (2.8-4.1 eV) in hexamethyl phosphoric triamide (HMPA). Cross sections are obtained by the recently developed method of energy distribution curve (EDC) superposition for photoelectron emission by solutions of sodium metal (5-96 mM liter^{-1}) in HMPA. The EDC's, spectral response curves for quantum yield, and cross section curves are discussed, and photoionization mechanisms are suggested for the Na^- species. Experimental methods are briefly outlined. This seems to be the first determination of cross sections for solvated electrons and the Na^- species in a liquid solution of high ionic conductivity. (auth)

13725 A PROBLEM CONCERNING RADIOGENIC METAMORPHIZATION OF NATURAL WATERS AND ROCKS. Bovk, I. V. (AN Ukrainskoj SSR, Kiev. Inst. Geologicheskikh Nauk). Litol. Polez. Iskop.; No. 1, 86-95(Jan 1974). (In Russian).

For English translation see the journal Lithol. Mineral. Resour.

Consideration is given to possible changes in the chemical, gaseous, and biological compositions of natural waters and minerals under the action of ionizing radiation, the sources of which are natural and artificial radioisotopes and cosmic rays. Problems are advanced on the metamorphic changes in the chemical and gaseous compositions of underground waters and the epigenetic conversions of minerals because of the radiolysis of underground waters. (tr-INIS)

13726 REDUCTION OF MIXED NiO-ZnO OXIDES WITH INCORPORATED RADIONUCLIDE ^{65}Zn BY HYDROGEN. Pospisil, M.; Cabicar, J. (Czech. Technical Univ., Prague). Collect. Czech. Chem. Commun.; 39: No. 11, 3056-3067(Nov 1974).

Reduction of mixed nickel and zinc oxides by hydrogen has been studied thermogravimetrically. Samples of various composition with incorporated ^{65}Zn were prepared by calcinating coprecipitated basic carbonates of both components at 400°C in air. The initial specific activity was 3 mCi/g ± 15%, the samples selected were prepared with specific activities of 0.87 and 22.5 mCi/g, respectively. Effect of radiation proper of the system manifests itself in a slow-down of the rate of reduction and in the increase of its apparent activation energy at low specific activities. The effect may be observed up to the temperature of 440°C and can be explained by a shift of equilibrium among different forms of adsorbed superstoichiometric oxygen of nickel oxide. Position of this equilibrium may be affected by a heat treatment of samples in the inert atmosphere before the reaction itself. At higher specific activities, an inversion of the effect takes place, the reduction proceeds at higher rate and with lower activation energy than with inactive samples. The kinetics of reduction of samples of both series can be described by an equation derived for zonal model of the decomposition of solids. (auth)

13727 TEMPERATURE DEPENDENCE OF SCAVENGER EFFECT ON TRAPPED ELECTRON PHOTOBLEACHING IN 8 M NaOH AND 5 M K_2CO_3 GLASSES. Kroh, J.; Plonka, A. (Technical Univ., Lodz, Poland). Chem. Phys., Lett.; 28: No. 2, 186-188(15 Sep 1974).

Upon photobleaching, trapped electrons seem to react with the scavenger molecules without the vertical transition through the conduction band. (auth)

13728 RADIATION TRANSFORMATION OF ETHANE ON THE SURFACE OF DEUTERATED SILICA GEL IN THE FIELD OF REACTOR NUCLEAR RADIATION. Nadirashvili, L. Sh. pp 38-53 of Yaderno-Khimicheskie Yavleniya v Tverdykh Telakh. Tsetskhladze, T. V. (ed.). Tbilisi, USSR; Izdatel'stvo Metsnichereva (1973). (In Russian).

Studies are made of the role of structural hydrogen and radiation-generated defects of silica gel in the radiation transformation of the systems silica gel-ethane and deuterated silica gel-ethane by n, γ radiation of the nuclear reactor. Relative yields of the main products of the system transformation are estimated depending on the dose rate. Possible mechanisms of their formation are discussed as well as the participation of structural hydrogen of the solid in the transformation of the absorbed substance. The role of a solid in this process is considered as a transmitter of the additional energy and as a third body providing better conditions of scattering of excitation energy for an absorbed molecule. The possibility of predominant formation of excited molecules and ions of parent molecule of the absorbed gas in the presence of a solid body is considered. By comparison of the data with studies of EPR spectra, the role of radiation-generated defects is considered as well as that of hydrogen hot atoms. (6 tables, 7 fig) (auth)

13729 EPR SPECTRUM OF HYDROGEN ATOMS IN SILICA GEL IRRADIATED IN A NUCLEAR REACTOR. Tsetskhladze, T. V.; Nadirashvili, L. Sh.; Berulava, B. G.; Tarkashvili, C. T. pp 95-108 of Yaderno-Khimicheskie Yavleniya v Tverdykh Telakh. Tsetskhladze, T. V. (ed.). Tbilisi, USSR; Izdatel'stvo Metsniereva (1973). (In Russian).

Studies were made of stabilization of atomic hydrogen in a matrix of silica gel irradiated in a nuclear reactor. Silica gel was irradiated both in vacuum and in the presence of different gases (hydrogen, ethane, oxygen) at 90°K in nuclear reactor channel. Samples were measured without heating at 77°K. Doublet of atomic hydrogen having a complex form is observed in EPR spectrum of the studied samples. The complexity of the doublet form is caused by two types of the atomic hydrogen centers of capture, anisotropy of the superfine interaction and the displacement of g-factor related to it. Mathematical modelling of the complex doublet analysis task using Computer M-220 was performed; expansion of the high-field part of the complex doublet is given. Study of EPR spectrum of the atomic hydrogen in irradiated silica gel stored for a year at 77°K proved the diffusion of atomic hydrogen at 77°K. (9 fig) (auth)

13730 ELECTRON SPECTRA OF INTERACTION PRODUCTS OF POLYENES WITH HALOGENS IN RADIATION- AND HEAT-MODIFIED POLY(VINYL CHLORIDE). Kolesnikova, V. V.; Kolninov, O. V.; Milinchuk, V. K.; Pshezhetskii, S. Ya. (Scientific Research Inst. of Physical Chemistry, Moscow). Vysokomol. Soedin., Ser. A; 16: No. 11, 2474-2478(Nov 1974). (In Russian).

The electron absorption bands in the near infrared region (10,000 to 4,000 cm^{-1}) in poly(vinyl chloride) subjected to both γ radiation and heat treatment were studied by a spectrophotometric method. The effect of different halogens on this absorption was investigated, and the dependence of the ir absorption maxima on the nature of the halogen was established. The data obtained showed that absorption in the ir may be related to transfer of the charge by donor-acceptor interaction of halogen atoms with polyenes. (tr-auth)

13731 ELECTRON SPIN RESONANCE OF GAMMA- AND X-IRRADIATED NUCLEIC ACID BASE PAIRS. 1-Methylcytosine: 5-Fluorouracil Co-Crystals at 77°K. Farley, R. A.; Bernhard, W. A. (Rochester Univ., NY). Radiat. Res.; 61: No. 1, 47-54(Jan 1975).

The predominant free radical trapped in single crystals of a hydrogen-bonded complex of 1-methylcytosine and 5-fluorouracil x-irradiated between 77°K and room temperature was identified. It is characterized by hydrogen atom extraction from N(1) of the 5-fluorouracil moiety, the unpaired electron interacting with the N(1) and F nuclei of this molecule. The principal values of the hyperfine

and g-tensors are: [A_x^N = 14.4, A_y^N = A_z^N = 0.0]; [A_x^F = 156.4, A_y^F = 16.4, A_z^F = 16.1 G]; [g_u = 2.00114, g_v = 2.00564, g_w = 2.00620]. The radical is present at 77°K and decays on warming to room temperature. There is at least one additional radical present at 77°K, but its structure has not been determined. (auth)

13732 ESR STUDY OF A BROMINE-CONTAINING RADICAL IN γ-IRRADIATED BROMOMALONAMIDE. Picone, R. F.; Rogers, M. T. (Michigan State Univ., East Lansing). J. Chem. Phys.; 61: No. 11, 4814-4819(1 Dec 1974).

Both powder and single-crystal ESR spectra of two paramagnetic species formed by γ-irradiation of bromomalonamide at 77°K have been obtained. One radical shows a large bromine hyperfine interaction plus a small proton interaction and the g, A(^{81}Br) and e^2qQ(^{81}Br) tensors have been determined from an analysis of the spectra of the deuterated form. The data have been interpreted as favoring the structure ·$CHBrCONH_2$ for this species. The second fragment has been identified as $CONH_2$, but ESR parameters are not reported since it has been studied previously. Neither species is stable at room temperature in the host crystal. (auth)

13733 CARBON-13 HYPERFINE SPLITTINGS OF NORMAL AND ABNORMAL METHYL RADICALS TRAPPED ON THE POROUS VYCOR GLASS SURFACE. Fujita, Y. (The Univ. of Tokyo); Katsu, T.; Sato, M.; Takahashi, K. J. Chem. Phys.; 61: No. 10, 4307-4311(15 Nov 1974).

To clarify the electronic structure and motional state of the abnormal methyl radical, we studied the ^{13}C-hf splittings of normal and abnormal methyl radicals photoproduced and stabilized on the surface of porous Vycor glass, as well as that of the methyl radical-iodide ion adduct prepared by γ-irradiation of $^{13}CH_3I$ in a CD_3CN matrix at 77°K. The ESR spectra of all the methyl radicals quoted above exhibited axially symmetric features with respect to the ^{13}C-hf (and ^{127}I-hf) tensors at low temperatures. A significant decrease in the isotropic ^{13}C-hf constant of the abnormal methyl radical compared with that of the normal one is interpreted in terms of the spin-delocalization onto the oxygen atom of the surface siloxane bridge, keeping its structure planar. The fact that the ^{13}C-hf tensors of all the methyl radicals show a trend of $A_{||}$ (^{13}C) > $A_{\perp}$ (^{13}C) implies that the normal and abnormal methyl radicals interact with the surface via the 2pπ unpaired-spin orbital and rotate around the C_3 axis. The temperature dependence of the isotropic ^{13}C-hf splitting of the normal methyl radical was also reexamined in the temperature range 77–300°K, and, accordingly, the result was found to agree well with the theoretical calculation by Schrader based on the extra coupling due to the out-of-plane vibration. (auth)

13734 THIN-LAYER CHROMATOGRAPHIC EXAMINATION OF THE RADIOLYSIS OF TBP–DILUENT–NITRIC ACID SYSTEMS. Nowak, M.; Nowak, Z.; Rochon, A. (Inst. of Nuclear Research, Warsaw). Radiochem. Radioanal. Lett.; 20: No. 1, 47-58(18 Dec 1974).

The radiolysis of tri-n-butyl phosphate (^{32}P-labeled)–diluent–nitric acid systems was studied. The products formed were separated by thin-layer chromatography. The influence of diluent as well as nitric acid concentration on the yield of radiolysis products are discussed. (auth)

13735 ELECTRON SPIN RESONANCE STUDIES OF THE e_{aq}^- ADDUCT TO FUMARIC ACID. Chawla, O. P.; Fessenden, R. W. (Carnegie-Mellon Univ., Pittsburgh). J. Phys. Chem.; 79: No. 1, 76-79(2 Jan 1975).

ESR spectra are reported for the mono- and dianion forms of the e_{aq}^- adduct to fumaric acid. Two forms of the monoanion, $[HO_2CCH = CHCO_2H]\cdot^-$, differing in the location of the protons on the carboxyl oxygens were found. Both have essentially the same pK_a value of 8.1 for dissociation to the dianion radical. With the identification of the mono- and dianions it is possible to correlate each of the esr spectra previously reported to a particular state of ionization of the radical. In several instances more than one spectrum had been observed at a particular pH, depending upon whether rapid exchange of the carboxyl protons occurred. The reactions of the trianion radical $[^-O_2CCH = CHCO_2^-]\cdot^-$ with water to form $^-O_2CCH_2\dot{C}HCO_2^-$ and for electron transfer from $(CH_3)_2\dot{C}O^-$ to fumarate are also reported. The latter reaction allowed production of such high signal intensities that the ^{13}C hyperfine constants ($a^C(2)$ = 4.39, $a^C(2)$ = 2.04 G) of $[^-O_2CCH = CHCO_2^-]\cdot^-$ could be determined. (auth)

13736 MECHANISM OF THE RADIATION-INDUCED DECOMPOSITION OF SODIUM NITRATE. I. Frances, A.; Johnson, E. R. (Univ. of Maryland, College Park). J. Phys. Chem.; 79: No. 1, 35-38(2 Jan 1975).

Experimental evidence is presented to show that the "apparent" increase in nitrite yield when nitrite is determined by the ceric sulfate method as compared to the method of Shinn is due to the presence of a color center and is not due to the presence of radicals such as NO_2, NO, N_2O_3, etc. as has been proposed. The color center is believed due to an O^- or O_2^- bound to the nitrite ion/or ions formed simultaneously. (auth)

13737 EFFECT OF THE NATURE OF CARBON BLACKS ON THE RADIATION STABILITY OF RUBBERS. Kazakov, A. V.; Bukanova, N. N.; Treboganova, V. M.; Lezhnev, N. N. (Scientific-Research Inst. of Rubber Industry, Moscow). Kauchuk Rezina; No. 8, 16-18(1974). (In Russian).

The type of carbon black surface determines its ability to retard the radiation aging of rubbers. The anthracene black exhibits a most pronounced effect in preventing the breakdown of rubbers made of SKI-3 and SKMS-30ARKM-15 material. This could be due to chemical characteristics of the aromatic compounds absorbed on the surface of soot particles during the process of soot formation. A method was proposed for modification of soots by increasing the content of incompletely carbonized particles of aromatic nature on their surface. This modification would improve the performance of rubbers under conditions of radiation. (auth)

13738 EFFECT OF SOME FILLERS AND ANTIOXIDANTS ON THE RESISTANCE OF IRRADIATED POLYETHYLENE TO THERMAL OXIDATION. Yanson, I. R. pp 31-34 of Modifikatsiya Svoistv Polimerov. Tarnopol'skii, Yu. M. (ed.). Riga; Izdatel'stvo Zinatne (1974). (In Russian).

The effect of fillers of lithopone, chalk, and carbon black and the antioxidants 22-46 and 4010 NA on the thermal oxidation of irradiated polyethylene was studied. Lithopone significantly increased the resistance of the polyethylene. There was a decrease of the antioxidant properties of chalk. The antioxidants 22-46 and 4010 NA increased the stability of the polyethylene. (tr-auth)

13739 CONDUCTIVITY MEASUREMENT DEVICE FOR STUDY OF FAST CHEMICAL REACTIONS IN PULSE RADIOLYSIS. Study of 4-Fluoro-Benzonitrile and 5-Bromouracil in Aqueous Solution. Klever, H. G. Bochum, Ger.; Ruhr-Universitaet (1974). 109p. (In German).

Thesis.

A conductivity measurement device was developed which maintains its almost automatic conductivity measurement with simultaneous spectroscopic measurements. The device can be inserted into existing measurement chains or can operate alone. The design, construction, and characteristics of the device are described in detail. It was used in the study of the pulse radiolysis of 4-fluoro-benzonitrile and 5-bromouracil. The G values of H_3O^+ and OH^- in Ar- and N_2O-saturated water were first determined. In the 5-bromouracil a complete splitting of the bromide from the radical anion was observed in the pH region from 4.7 to 8.7. Fluoride elimination from the 4-fluoro-benzonitrile by solvated electrons was studied. The reactions of the radical anion with H atoms and with OH radicals were measured. (JSR)

13740 RADIATION CHEMISTRY OF POLYCRYSTALLINE 1-CHLOROPROPANE. de Jonge, D.; Ceulemans, J. (Univ. Louvain, Belgium). Bull. Soc. Chim. Belg.; 83: No. 11-12, 397-406(1974).

The radiation chemistry of polycrystalline 1-chloropropane at 77°K was studied, with special emphasis on the influence of irradiation time. The most important dose effect is a very marked decrease of the yield of hexane as a function of the dose. The concentration of this product even passes through a maximum at high doses. A comparison was made with dose effects in glassy 1-chloropentane; the most important differences are additional positive dose effects on certain dichloropentanes and dichlorodecanes in 1-chloropentane. Two distinct processes appear to be responsible for dose effects in irradiated chloroalkanes at 77°K. The first is the reaction of mobile hydrogen atoms with neutral radicals, causing a decrease of the yield of these radicals in function of the dose. The second is charge transfer of radicals and olefins, which were formed in an earlier stage of the radiolysis. Both effects are present in glassy 1-chloropentane but only the first does manifest itself in polycrystalline 1-chloropropane. This may be due to a greater range of the secondary electrons or to better migration possibilities of chloride ions in glassy 1-chloropentane than in polycrystalline 1-chloropropane. In view of other experimental results, the last explanation seems to be the most plausible. (auth)

13741 METHOD FOR MANUFACTURING INTERNALLY-COATED POROUS MACRO-MOLECULAR MATERIALS, AND MATERIALS THUS OBTAINED. Marchand, J.; Puig, J. R. (to Commissariat a l'Energie Nuclear). French Patent 2,181,215/D/. 21 Apr 1972. 13p. (In French).

The method comprises submitting a polymer to irradiation by

heavy nuclear particles, chemically fixing a monomer having at least one double ethylenic link in areas altered by the irradiation and localized about the path of each particle, and generating porosity by means of a chemical etchant selected according to said polymer. The materials thus obtained can be used, for example, as ion-exchanger membranes or as selective semipervious membranes. (FR)

13742 A KINETIC ANALYSIS OF THE RESULTS FROM THE RADIOLYSIS OF ETHANOL/ETHYLENE SYSTEMS. Van Wyk, L. (Atomic Energy Board, Pelindaba, Pretoria (South Africa). Radiation Chemistry Div.). J. S. Afr. Chem. Inst.; 27: 8-13(1974).

Kinetic expressions for analyzing results obtained from the radiolysis of ethanol–ethylene systems were derived. All equations are expressed in terms of 100-eV yield (G-value) rather than on the basis of reaction rate. A procedure was developed to estimate the yield of a normally unseen back reaction. (INIS)

13743 ON DECOMPOSITION MECHANISM OF HYDROGEN PEROXIDE WATER SOLUTIONS WHEN INFLUENCED BY DIFFERENT DECOMPOSITION INITIATORS. Majboroda, V. D.; Petryaev, E. P.; Byakov, V. M. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki; Belorusskij Gosudarstvennyj Univ., Minsk). Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk; No. 3, 50-53(1973). (In Russian).

It was shown that the mechanism of the decomposition of Allen water into its chemical stages can serve as a model for the radiolysis, photolysis, and thermolysis of aqueous solutions of hydrogen peroxide. An equation derived by the method of stationary concentration agreed well with experimental data. (tr-auth)

13744 APPLICATION OF POLAROGRAPHY AND OSCILLOPOLAROGRAPHY TO RADIATION RESEARCH. Pleticha-Lansky, R. (Ceskoslovenska Akademie Ved, Prague. Ustav Experimentalni Botaniky). Radiat. Res. Rev.; 5: No. 3-4, 301-339 (Oct 1974).

79 references.

In 1922 J. Heyrovsky introduced a new electroanalytical method called polarography. The method involved registering the current which passes through a dropping mercury indicator electrode as a function of the voltage, applied to an electrolytic cell. According to the present international convention, this classical dc polarography is considered as voltammetry with the dropping mercury electrode. The principles of this method are widely known to chemists. Various modifications and improvements of classical polarography have led to use of the method, especially in chemical analysis, reaction kinetics and chemical structure. This review discusses the general applications of polarography in radiation chemistry and biochemistry and discusses other methods derived from dc polarography. The instrumentation used is discussed. (NL)

13745 THE EFFECT OF RADIATION ON ELECTRODE PROCESSES. Airey, P. L. (Australian Atomic Energy Commission Research Establishment, Lucas Heights. Isotope Div.). Radiat. Res. Rev.; 5: No. 3-4, 341-371(Oct 1974).

130 references.

In this review, the effects of irradiation are classified depending on whether they arise from the absorption of radiation (i) in the bulk solution, (ii) in the interfacial region, or (iii) in the electrode material. In the majority of cases the classification is satisfactory. An exception is the case of hydrogen electrodes, where effects have been attributed both to the absorption of radiation in the platinum metal and in the surrounding electrolyte. It is inevitable that a selection must be made of the available material. Many radiation electrochemical systems which have not been closely enough defined to permit adequate interpretation of the results have been omitted. Discussion of radiation electrochemical techniques, such as pulse conductivity, which have only been applied to the study of the radiolysis of the bulk solution have also been excluded. Reference has been made to photochemical effects only when they contribute directly to the understanding of a radiation process. No attempt has been made to include the vast literature on radiation corrosion. (NL)

13746 THE EFFECT OF RADIATION ON GASES ABSORBED ON ALUMINA. Norfolk, D. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Radiat. Res. Rev.; 5: No. 3-4, 373-489(Oct 1974).

154 references.

This review compares the mechanisms by which adsorbates on Al_2O_3 react when only heat energy is supplied with those occurring when the system is bombarded with high-energy radiations, and so determines which properties of either component control radiolytic activity. Because of the electronic nature of Al_2O_3, energy from γ-irradiation deposited in the bulk solid is readily transported to the surface as excited electrons with which adsorbed molecules can react. The extent of such energy transfer from solid to adsorbate is found to depend on the degree of outgassing of the surface: only at sites where the electron orbitals of solid and adsorbate overlap can transfer take place. Equally important are the electron affinity and ionization potentials of the adsorbate, which determine the probability of electron transfer to or from the solid. The chemical effect of the energy deposited in the adsorbate depends on the strength of the bonds in the molecule, and on the energetics of the possible reactions. Hydrogen is in equilibrium on unirradiated Al_2O_3 with a small concentration of surface H atoms, and oxygen is undissociated: when the systems are γ-irradiated, each gas is dissociated at surface sites by energy transferred from the solid. CO, CO_2, and alcohols react with Al_2O_3 in the absence of radiation only by ionic paths: γ-irradiation causes decomposition via radicals, again initiated at surface sites. Hydrocarbons, normally rather unreactive with Al_2O_3, also decompose through radical intermediates when γ-irradiated. (auth)

13747 RADIOLYSIS OF ALKENES. II. Light Hydrocarbon Products from Some Normal and Cyclic Alkenes. Cserep, G.; Foldiak, G. (Inst. of Isotopes, Budapest). Acta Chim. Acad. Sci. Hung.; 83: No. 2, 171-183(1974).

Various normal and cyclic alkenes with different molecular sizes were irradiated in liquid phase with a ^{60}Co γ-radiation source. On the basis of the yields of C_1 to C_5 fragments it is concluded that in spite of the very high primary energy, the primary decomposition of the molecules occurs at bonds which are loosened. Owing to the delocalization of π electrons in the alkenes, σ-bonds in β-position have the smallest energy of dissociation, however, other effects such as chain ends or unpaired electrons of free radicals, as well as the strain energy of the molecules may also influence the product composition. (auth)

13748 RADIOLYSIS OF ALKENES. III. Light Hydrocarbon Products from Some Branched Aliphatic and Cyclic Alkenes. Cserep, G.; Foldiak, G. (Inst. of Isotopes, Budapest). Acta Chim. Acad. Sci. Hung.; 83: No. 2, 185-194(1974).

Various branched-chain aliphatic and side-substituted cyclic alkenes were irradiated in liquid phase with a ^{60}Co γ-radiation source. The yields of light hydrocarbons produced show that branching, i.e., the presence of tertiary carbon atoms also has a significant influence upon the decomposition of these hydrocarbons. The loosening effect of tertiary carbon atoms competes in some cases with that caused by the π-bond in β-position; in other cases the two effects are cumulative. Chain ends as well as secondary processes may also influence the product composition. (auth)

13749 NEW RADIOCHEMICAL METHOD FOR DETERMINING THE OSCILLATOR STRENGTH OF F CENTRES IN ALKALI HALIDES. Bosi, L. (Inst. of Fisica del Politecnico, Milan); Fantola Lazzarini, A. L.; Lazzarini, E. Phys. Status Solidi (b); 66: No. 1, 285-293(1 Nov 1974).

A new radiochemical method for determining the concentration of F centers in x- or γ-ray colored crystals of alkali halides is described. The method is based on the fact that crystals containing F centers on dissolution in water give rise to the formation of an equal amount of hydrated electrons. Hydrated electrons are able to reduce $[Co(NH_3)_6]^{3+}$ complex ions to Co^{2+}; thus, by dissolving crystals containing F centers in a water solution of $[Co(NH_3)_6]^{3+}$ ions, the amount of Co^{2+} ions formed is related to the concentration of F centers in the crystals. The sensitivity of the Co^{2+} determination can be improved by using ^{60}Co-labeled $(CoA_6)^{3+}$ ions and counting the ^{60}Co with a NaI(Tl)detector. The method was applied to the determination of F center concentration in NaCl, KCl, and KBr crystals colored by ^{60}Co γ-irradiation. The use of these concentrations in the Smakula absorption formula enables to calculate the optical oscillator strength f of F centers. The f values obtained are as follows: $f_{NaCl} = 0.64 \pm 0.02$; $f_{KCl} = 0.68 \pm 0.02$; $f_{KBr} = 0.72 \pm 0.02$. These results are compared with those already reported in literature. (auth)

13750 MECHANISM OF THE SULFURIC-ACID DISSOLUTION OF URANIUM OXIDES IN A FIELD OF γ RADIATION. Spitsyn, V. I.; Gromov, V. V.; Abdulaev, D. (Inst. of Physical Chemistry, Moscow). Dokl. Phys. Chem.; 216: No. 1-3, 475-478(May 1974).

Translated from Dokl. Akad. Nauk SSSR; 216: No. 2, 356-359 (May 1974).

The mechanism of the action of ^{60}Co γ radiation on the kinetics of the dissolution of finely disperse powders of UO_2 and U_3O_8 in 0.1 N H_2SO_4 was studied at 23 ± 1°C. Under the influence of radiation the passage of U into the liquid phase increases for both oxides and the rate of dissolution increases with an increase of dose rate. On the basis of the conclusion that the deciding factor in the acceleration of the passage of U into the liquid phase is the reaction of the oxides with the radical radiolysis products of water, a formula is derived connecting the rate of dissolution v with the

radiation intensity. The experimental and calculated dependence of log Δ ν on the log of the radiation intensity is in good agreement. (JSR)

13751 INVESTIGATION OF MIXTURES OF POLYETHYLENE WITH COPOLYMERS OF FORMALDEHYDE AND DIOXOLANE BY THE METHOD OF RADIOTHERMOLUMINESCENCE. Lipatov, Yu. S.; Vonsyatskii, V. A.; Mamunya, E. P.; Boyarskii, G. Ya. (Inst. of Chemistry of High-Molecular Compounds, Kiev). Vysokomol. Soedin., Ser. B; 16: No. 11, 838-839(1974). (In Russian).

The radiothermoluminescence of mixtures of polyethylene (PE) with copolymers of formaldehyde and dioxolan (CFD) was measured after electron irradiation at ~10^5 eV to a dose to 2 Mrad. The results showed that small additions of CFD to PE and of PE to CFD caused local or segmented solubility as a result of which one displaced luminescent peak was observed in both PE and CFD. With increase of the concentration of PE in CFD or of CFD in PE the amorphous phase consists of two regions which lead to the appearance of two glassification temperatures. (JSR)

13752 GAMMA-RADIOLYSIS OF 6-AMINOPENICILLANIC ACID AND ITS DERIVATIVES. Dziegielewski, J. (Univ., Wroclaw); Jezowska-Trzebiatowska, B.; Kalecinska, E.; Siemion, I. Z.; Kalecinski, J.; Nawojska, J. Nukleonika; 18: No. 11, 11-20(1973).

The radiation decompositions of 6-aminopenicillanic acid, penicillins (benzylpenicillin acid and its salt: potassium and procainum) as well as syntarpen (cloxacyllin), phenoxymethylpenicillin, and methyl phenoxymethylpenicillin ester were examined. The yields of antibiotic decomposition were determined by the CD (circular dichroism) and ORD (optical rotary dispersion) methods and also by iodometric and spectrophotometric methods. These yields are the lowest for 6-APA and the highest for syntarpen and benzylpenicillin acid decomposition. The yields of radicals and gaseous products (mainly CO and CO_2) were also measured. These yields are decreasing in the same order as the yields of antibiotic decomposition. The main conclusion drawn here is that the β-lactum ring is the most susceptible for irradiation. (auth)

13753 RADIATIVE SULFOXIDATION OF N-PARAFFINS. Part II. Kowalski, A.; Bogus, W.; Perkowski, J. (Interdepartmental Inst. of Radiation Tech., Lodz, Poland). Nukleonika; 18: No. 11, 1-10(1973).

Results are presented of the studies on radiative sulfoxidation of a $C_{14}-C_{17}$ n-paraffin fraction. The paraffins containing about 0.001% of aromatic compounds and about 0.0025% of water were found to consume the minimum quantity of energy, viz., 250 to 300 rads, to induce the reaction. Other initiators like visible light and ultraviolet rays act similarly as does the ionizing radiation. After having been initiated, the reaction proceeds spontaneously, provided the gaseous reactants fed have been appropriately dried. The ratio of reactor's active surface area to reacting paraffins volume is of major consequence; for example, with a helical-shaped reactor, the process could not be initiated even with a dose as high as 1.75 Mrad, whereas in a typical reactor a dose of 0.3 Mrad proved to be effective. As the reaction proceeds, the ratio of alkanesulfonic acids to sulfuric acid is seen to exhibit an upward trend in the reaction products. Judging by the observed relation of the degree of paraffin purity to the energy required to initiate the process and by the capacity of the reaction to continue to proceed spontaneously after initiation, it appears that the process concerned lends itself to commercial scale applications. (auth)

13754 INVESTIGATION OF THE INTERMEDIATE STEPS IN THE PHOTOREDUCTION OF URANYL IONS. Sergeeva, G. I.; Chibosov, A. K.; Levshin, L. V.; Karyakin, A. V.; Myasoedov, B. F.; Nemodruk, A. A. (Inst. of Geochemistry and Analytical Chemistry, Moscow). High Energy Chem. (USSR) (Engl. Transl.); 8: No. 4, 299-302(1974).

Translated from Khim. Vys. Energ.; 8: No. 4, 358-362(1974).

The pulse photolysis method was used to investigate the elementary reactions for the conversion of the intermediate U(5+) formed during the photoreduction of uranyl ions by ethanol, ascorbic acid, and hydroquinone in 1 M H_2SO_4. It was found that U(5+) can be consumed in two ways: by disproportionation of U(5+) with the formation of U(4+), or by the reaction of U(5+) with a radical from the reducing agent. The process that predominates depends essentially on the nature of the reducing agent. Rate constants were determined for the processes investigated. (auth)

13755 INVESTIGATION OF THE PARAMAGNETIC PRODUCTS FROM THE RADIOLYSIS OF INDOLINE SPIROPYRANS. Zubkov, A. V. High Energy Chem. (USSR) (Engl. Transl.); 8: No. 4, 296-298(1974).

Translated from Khim. Vys. Energ.; 8: No. 4, 354-357(1974).

ESR spectra due to paramagnetic particles stabilized during the low-temperature radiolysis of indoline spiropyrans were recorded. The results are explained on the basis of the ionic nature of the paramagnetic particles produced by γ irradiation of the spiropyrans. (auth)

13756 ESR SPECTRA OF X-IRRADIATED ANHYDROUS LITHIUM AND BERYLLIUM SULFATES AND THEIR EUTECTIC. Vasil'ev, V. G.; Vashman, A. A. High Energy Chem. (USSR) (Engl. Transl.); 8: No. 4, 292-295(1974).

Translated from Khim. Vys. Energ.; 8: No. 4, 349-353(1974).

The ESR method was used to investigate the effects of γ radiation on anhydrous lithium and beryllium sulfates and their eutectic. The radiation yields of paramagnetic centers (PMC) in Li_2SO_4, $BeSO_4$, and the eutectic were found to be $6 \cdot 10^{-3}$, $1.5 \cdot 10^{-2}$, and $4.5 \cdot 10^{-2}$ centers/100 eV, respectively. The PMC in these salts are due to radicals of the electron hole type. The mechanism of their formation is discussed. (auth)

13757 INVESTIGATION OF PARAMAGNETIC CENTERS PRODUCED IN POLYSTYRENE AND ITS METHYL DERIVATIVES BY LOW-TEMPERATURE γ-RADIOLYSIS. Chernova, I. K.; Golikov, V. P.; Leshchenko, S. S.; Muromtsev, V. I.; Karpov, V. L. (Inst. of Physical Chemistry, Moscow). High Energy Chem. (USSR) (Engl. Transl.); 8: No. 4, 286-291(1974).

Translated from Khim. Vys. Energ.; 8: No. 4, 342-348(1974).

Paramagnetic centers (PC) appearing in polystyrene (PS), polyvinyltoluene (PVT), and poly-α-methylstyrene (PαMS) on exposure to γ rays at 77°K were investigated. In all three polymers PC related to ion-radicals appear at doses of 1 to 5 Mrad; at higher doses radicals resulting from the addition of H atoms to the benzene ring were observed. After uv "bleaching" the γ-irradiated polymers alkylbenzene radicals were observed; in PVT the radicals result from H atom abstraction from the CH_3-group, in PS and PαMS from destruction of the chain. After heating the three polymers to 295 to 373°K polyene radicals are observed. The rates of formation and destruction of the different PC in these polymers were studied. The role of radical processes in PS and its different methyl derivatives is discussed with respect to radiation modification. (auth)

13758 RADIOCHEMICAL SYNTHESIS OF ION-EXCHANGE MEMBRANES ON AN ENLARGED SCALE. Rozenblyum, N. D.; Chepel, L. V.; Kocherginskaya, L. L.; Margolin, D. M.; Zhitkova, L. G.; Vasil'ev, L. A.; Terekhov, V. D.; Stasyuk, Kh. A. High Energy Chem. (USSR) (Engl. Transl.); 8: No. 4, 283-285(1974).

Translated from Khim. Vys. Energ.; 8: No. 4, 339-341(1974).

A description is given of the synthesis of ion-exchange membranes on an enlarged scale by the graft copolymerization of vinyl monomers on an irradiated polyethylene film, followed by its treatment to introduce ionogenic groups. The radiation source was an accelerator with an expanded electron beam. The optimum irradiation conditions and grafting mixture composition were chosen. The uniformity of the membranes obtained was demonstrated by measurements of their electrical resistivity. (auth)

13759 REACTIVITY OF ELECTRONS IN THE γ-RADIOLYSIS OF GLASSY ALCOHOLS AND WATER–ALCOHOL MIXTURES AT 77°K. Girina, E. L.; Ershov, B. G.; Pikaev, A. K. (Inst. of Physical Chemistry, Moscow). High Energy Chem. (USSR) (Engl. Transl.); 8: No. 4, 279-282(1974).

Translated from Khim. Vys. Energ.; 8: No. 4, 334-338(1974).

Optical absorption spectroscopy was used to investigate electron stabilization processes in glassy methanol, ethanol, isopropanol, isobutanol, and water–methanol mixtures, irradiated with γ rays at 77°K in the presence of electron scavengers. It was found that the yield of stabilized electrons does not obey the equations of competition kinetics. This is assumed to be due to long-range electron transfer to the scavenger by a tunneling mechanism. The kinetics of electron stabilization are discussed on that basis. The relative rate constants for the reactions of electrons with different scavengers were calculated, and values of the tunneling-transfer distances were found to be 15 to 30 Å, depending on the nature of the matrix and scavenger. (auth)

13760 EFFECT OF TEMPERATURE AND ELECTROLYTE IONS ON THE PROPERTIES AND SPECTRUM OF SOLVATED ELECTRONS IN IRRADIATED HEXAMETHYLPHOSPHORIC TRIAMIDE. Mal'tsev, E. I.; Vannikov, A. V. (Inst. of Electrochemistry, Moscow). High Energy Chem. (USSR) (Engl. Transl.); 8: No. 4, 274-278(1974).

Translated from Khim. Vys. Energ.; 8: No. 4, 328-333(1974).

Pulse radiolysis, with optical and electrical recording of the short-lived products, was used to investigate the effect of temperature and electrolyte ions on the short-lived absorption spectrum of electron-irradiated hexamethylphosphoric triamide (HMPA). The spectrum of e^-_{solv} in HMPA was recorded up to λ = 2000 nm.

In the uv region the spectrum of the short-lived absorption was obtained down to $\lambda \approx 2000$ nm and ascribed to short-lived radicals of appropriate structure. The activation energy for the reaction of e^-_{solv} with Cu^{2+} was found to be 1.8 kcal/mole. From the results a mechanism is suggested for the movement of e^-_{solv} in HMPA and other polar liquids. (auth)

13761 RADIOCHEMICAL SYNTHESIS OF XENON FLUORIDES IN A NUCLEAR REACTOR. Il'in, E. K. High Energy Chem. (USSR) (Engl. Transl.); 8: No. 4, 270-273(1974).

Translated from Khim. Vys. Energ.; 8: No. 4, 323-327(1974).

Xenon fluorides were synthesized by irradiation of a mixture of xenon and fluorine in a nuclear reactor, using ^{235}U fission fragments or the mixed n,γ radiation from the reactor. The kinetics of the process were studied over a wide range of conditions in the system. Determinations were made of the radiation yield and the stationary concentration of xenon fluorides. (auth)

13762 STUDY OF THE ROTATIONAL AND VIBRATIONAL LEVEL DISTRIBUTION OF EXCITED CH AND C_2 PRODUCED BY THE DISSOCIATION OF C_2H_2 BY ELECTRON IMPACT. Polyakova, G. N.; Fizgeer, B. M. (Gorky State Univ., USSR). High Energy Chem. (USSR) (Engl. Transl.); 8: No. 4, 252-256 (1974).

Translated from Khim. Vys. Energ.; 8: No. 4, 301-306(1974).

A study was carried out on the distribution of the molecules $CH(A^2\Delta, B^2\Sigma^-)$ and $C_2(A^3\Pi_g)$ over the rotational and vibrational levels. Excited CH and C_2 molecules were generated by the dissociation of C_2H_2 by electron impact (electron energy 300 eV). The distribution of these fragment molecules over the rotational energy levels was found to be Boltzmann. The distribution of $C_2(A^3\Pi_g)$ over the vibrational levels also was Boltzmann. The effective rotational and vibrational temperatures of $C_2(A^3\Pi_g)$ do not coincide. The measured rotational and vibrational distributions were compared with distributions calculated from a statistical model. (auth)

Radiochemistry and Nuclear Chemistry

Refer also to abstracts 14509, 15296, and 15476.

13763 (INIS-mf-1281) REVISION AND OPTIMIZATION OF THE METHODS OF LABELLED SAND WITH Au-198. Perez, N. A. M. (Instituto Tecnologico Regional de Veracruz (Mexico)). 1973. 51p. (In Spanish). INIS.

Thesis.

Several procedures were combined for labelling sands with ^{198}Au for the purpose of studying the transport of sediments. The most adequate method consisted first of exposing the sand to the action of concentrated HNO_3 for an hour in order to eliminate the calcareous compounds adhering to the sand; when these were eliminated, the sand is shaken in a boiling solution of 15% NaOH for an hour in order to form a silica gel coating around each grain. The sand is then shaken for an hour in a solution of $SnCl_2 \cdot 2H_2O$ using 2.5 g of the salt for each 50 g of salt. The Sn is reduced to the metallic form on the surface of the sand. The sand is exposed to an additional treatment with $AgNO_3$ to form a Ag mirror using 0.5g of Ag for each 50 g of sand. Precipitation on the sand is preferential by the use of pyridine and hydrazine sulfate. Part of the Sn is exchanged with the Ag. The treated sand is placed in contact with a solution of tetrachloroauric acid. The Au is exchanged with the Sn and Ag and adheres firmly to the grain of sand. A fixation efficiency better than 95% is obtained. (tr-auth)

Hot-Atom Chemistry

Refer also to abstract 13728.

13764 (COO-2190-13) GAS PHASE REACTIONS OF SULFUR-38 AND SULFUR-35 ATOMS GENERATED BY NUCLEAR RECOIL. Kremer, L. N. III. (Utah Univ., Salt Lake City (USA). Dept. of Chemistry). Fal 1974. 146p. Dep. NTIS $10.50.

Thesis.

Reactions of nuclear recoil generated sulfur atoms with H_2S, CH_4, H_2, and CS_2 were studied in the gas phase. The sulfur isotopes ^{38}S and ^{35}S used in these studies were produced via the $^{40}Ar(p,3p)^{38}S$, $^{34}S(n,\gamma)^{35}S$, and $^{35}Cl(n,p)^{35}S$ nuclear reactions. Radio gas chromatography was used to determine the gas phase product yields. In order to analyze COS, H_2S, and SO_2 as well as organosulfur compounds a reversing flow gas chromatographic system was developed which separates all of these compounds in a single pass. The major finding of this dissertation is the importance of electronic states in the reactions of nuclear recoil sulfur. Pressure and concentration studies of the H_2S-Ar system indicate that the $S(^1D)$ reaction with H_2S leads to the formation of a vibrationally excited complex. Ground state, $S(^3P)$, reaction with H_2S is postulated to form HSSH which decomposes on the reaction vessel wall. Experiments with CH_4 suggest $S(^1D)$ insertion into the C–H bond to form CH_3SH and also support the interpretation of the Ar-H_2S experiments. Computer fitting of kinetic models to the data indicate that the rate constant for the $S(^1D)$ reaction with H_2S is comparable with the known rate constant of $S(^1D)$ reaction with CH_4. Studies of the sulfur atom reactions with H_2 can be interpreted either in terms of $S(^1D)$ insertion, or a hot primary reaction producing highly energetic HS radical intermediates. The CS_2 reaction data can also be explained as $S(^1D)$ reaction to form labeled CS_2 in the gas phase. (auth)

13765 (COO-2190-15) DYNAMICS AND MECHANISMS OF HOT CHEMISTRY STIMULATED BY RECOIL METHODS (GAS PHASE STUDIES OF THE KINETICS AND MECHANISM OF HIGH ENERGY SULFUR ATOM REACTIONS AND SOME NOVEL ASPECTS OF HOT HALOGEN REACTIONS). Progress Report, March 1, 1974–February 28, 1975. Spicer, L. D. (Utah Univ., Salt Lake City (USA)). 1974. Contract AT(11-1)-2190. 25p. Dep. NTIS $4.25.

A systematic study of the reactions of nuclear recoil sulfur atom chemistry is reported. ^{38}S was produced by the $^{40}Ar(p,3p)^{38}S$ reaction, and ^{35}S was generated by both the $^{35}Cl(n,p)^{35}S$ and $^{34}S(n,\gamma)^{35}S$ nuclear reactions. Evidence for electronically excited $S(^1D)$ reactions with H_2S, CH_4, H_2, and CS_2 has been found. General properties of importance in the excitation labeling of carrier-free H_2S and CH_3SH with ^{38}S have also been characterized. The effect of inelastic processes associated with vibrational and electronic excitation on the collisional distribution function for nuclear recoil atoms has been found to be small in the $T + H_2$ system. In these calculations model excitation functions were used to represent the inelastic processes of interest. The reaction of recoil chlorine atoms with H_2 and D_2 was studied. The scavenging efficiency of ethylene and iodine was established and found to contribute to the HCl yield in a pressure dependent manner. At 50% moderation with CF_2Cl_2 an inverse isotope effect of ~1.4 is observed for the hot reaction. Finally, relative energy transfer efficiencies were estimated for collisions between highly excited cyclobutane-t and Ne, Ar, CF_4, and parent bath gases. The relative ordering of efficiencies is found to be $CF_4 \geq c\text{-}C_4H_8 > Ne > Ar$. (auth)

13766 YADERNO-KHIMICHESKIE YAVLENIYA V TVERDYKH TELAKH. (Nuclear Chemical Phenomena in Solids). Tsetskhladze, T. V. (ed.). Tbilisi, USSR; Izdatel'stvo Metsniereva (1973). 123p.

Experimental data on the interaction of nuclear radiation and particularly tritium atoms with the crystalline lattice of solids and their surfaces are reported in a collection of 6 papers. Data are reported on the character of the gaseous diffusion in the irradiated solids. Problems of automation of nuclear-chemical experiments and some experimental methods especially appropriate for the study of irradiated solids are examined. Separate abstracts were prepared for each paper. (tr-auth)

For abstracts of individual papers see: 13728, 13729, 13767, 13768, 14141, and 14692.

13767 INTERACTION OF A RECOIL ATOM WITH THE LATTICE IN THE DISPLACEMENT SPIKES. Tsetskhladze, T. V. pp 5-37 of Yaderno-Khimicheskie Yavleniya v Tverdykh Telakh. Tsetskhladze, T. V. (ed.). Tbilisi, USSR; Izdatel'stvo Metsniereva (1973). (In Russian).

Chemical interaction of recoil atoms with the lattice of solids is one type of radiation damage in a crystal. Starting from the primary picture of interaction and finishing with the processes of thermal and radiation annealing, all the stages of hot-atom existence in a solid may be correctly understood and adequately described only in the light of the latest achievements of radiation physics of solids. Recoil atoms produced in nuclear reactions taking place in solids experience resulting interaction with the lattice in the displacement spikes and undergo focusing and channelling phenomena. Shading effects may also affect them. Physical processes accompanying the passage of a fast particle in a solid are considered and the evaluation of their role in the chemical interaction of a recoil atom with the lattice is given. (12 fig, 84 references) (auth)

13768 REACTIONS OF TRITIUM HOT ATOMS WITH AN ADSORBED TARGET. Cherkezishvili, L. I. pp 54-70 of Yaderno-Khimicheskie Yavleniya v Tverdykh Telakh. Tsetskhladze, T. V. (ed.). Tbilisi, USSR; Izdatel'stvo Metsniereva (1973). (In Russian).

A review of papers devoted to the studies of interaction of hot

atoms with different organic compounds is given, with emphasis on reactions of hydrogen hot atoms with hydrocarbons. Characteristics of the methods for hot atom production and their advantages and disadvantages are given. The main types of reaction of tritium atoms with hydrocarbons in the hot region are considered and criteria for distinguishing these reactions from reactions of thermalized hydrogen atoms are shown. Modern ideas on the mechanism of interaction of tritium hot atoms with saturated and unsaturated hydrocarbons are given. According to one concept in the reaction of a hot atom with a medium producing a labelled molecule, an excited molecule is produced at the first stage of interaction. The probability of such a molecule stabilization depends on the possibility of scattering of excessive energy. If such conditions which promote excitation energy scattering are created, then the probability of labelled molecule formation will be increased. Such conditions are created when the substance with which hot atoms interact is adsorbed on a solid with large specific surface. Results of studies of such a system confirm the validity of the idea on excited molecule production. (44 references) (auth)

13769 REACTIONS OF ENERGETIC CARBON ATOMS PRODUCED BY $^{12}C(p,pn)^{11}C$ IN ALKANES AND ALKYL CHLORIDES: MODERATOR EFFECTS AND DEUTERIUM ISOTOPE EFFECTS. Taylor, K. K. C. Blacksburg, VA; Virginia Polytechnic Inst. and State Univ. (1974). 127p. University Microfilms Order No. 74-29,139.

Thesis (Ph. D.).

The reactions of energetic carbon atoms produced by the nuclear reaction $^{12}C(p,pn)^{11}C$ in some specifically deuterated ethanes and propanes were investigated. Evidence was put forth that supports the contention that ethylene-^{11}C is produced via insertion of methyne into a methyl C–H bond of the alkane, followed by unimolecular decomposition. Two isotope effects were found to be operative in the production of ethylene in hydrocarbons. The average ratio of CH/CD produced in alkanes was found to be 0.83. The second isotope effect indicated that the ease of insertion into CH_3 groups compared to insertion into CD_3 groups is 1.41. A bond energy effect was also noted in these systems. Methyne is formed more easily from secondary than from primary hydrogens by a factor of 1.3. The yields of major ^{11}C-labeled products in xenon moderated ethane were compared to earlier data for ethane in neon and helium moderators. The results suggest that ethylene-^{11}C is primarily the product of the ^1D electronic state of carbon and acetylene-^{11}C is the product of the ^3P state at high energies. At lower energies acetylene can no longer be formed by C(^3P), but can be produced by C(^1D), as can ethylene. Experiments with alkyl chlorides provided evidence that methyne can be formed both by direct abstraction and by insertion of ^1D carbon into a C–H bond, followed by decomposition of the intermediate to give methyne. In analogy to the selective reactions of singlet and triplet methylene, the data suggest that carbon ^1D selectively abstracts chlorine, giving chloromethyne which subsequently is oxidized to carbon monoxide-^{11}C. The overall effect is to divert ^1D carbons from methyne production, sharply reducing the ethylene-^{11}C yields in these substrates. A consequence of this diversion is that the residual ethylene is formed almost exclusively by abstraction of hydrogen by ^3P carbon, thus altering the isotope effect for methyne production. The ratio of CH/CD which ultimately results in ethylene was found to be 1.1 in alkyl chlorides. (Diss. Abstr. Int., B)

Properties of Radioactive Materials

Refer also to abstracts 13750, 13754, 14016, 14095, 14342, 14412, 14482, 14490, and 14497.

13770 (CEA-N-1727) NATURAL URANIUM. Health Physics Principles Applied to the Machining of Natural Uranium. Remond, A. (CEA Centre d'Etudes de Vaujours, 93 - Sevran (France)). Mar 1974. 20p. (In French). Dep. NTIS (US Sales Only) $4.00.

The chief physical, chemical, and radioactive properties of natural uranium are reviewed, together with the safety norms which should be applied in order to limit contamination and irradiation risks. (FR)

13771 (CONF-721239–P2) PROCEEDINGS OF THE CHEMISTRY SYMPOSIUM: ALIGARH MUSLIM UNIVERSITY, ALIGARH, DECEMBER 21–23, 1972. Volume II. Physical Methods in Structural Inorganic Chemistry, Actinide Chemistry and Solid State Studies. (Department of Atomic Energy, Bombay (India)). 1972. 374p.

Of the 48 papers presented, 20 were abstracted and indexed separately for NSA. (LK)

For abstracts of individual papers see: 13615, 13616, 13655–13662, 13782–13787, 13823, 13824, 14529, and 14530.

13772 (CONF-740115-, pp 2-7) CHEMISTRY OF PLUTONIUM IN RELATION TO ITS BEHAVIOR IN BIOLOGICAL AND ENVIRONMENTAL SYSTEM. Matlack, G. M. (Los Alamos Scientific Lab., NM). Dec 1974.

From plutonium information meeting; Los Alamos, New Mexico, USA (4 Jan 1974).

In plutonium information meeting.

The chemical, physical, and radiation properties of Pu are reviewed. Topics discussed include: the isotopic composition and radioactive characteristics of reactor-grade Pu; the solubility of Pu metal; the characteristics of various Pu compounds, Pu ions in solution, and organic and inorganic complexes of Pu; polymerization conditions for Pu; and the mechanisms for α-particle induced reduction of Pu oxides in solutions. (CH)

13773 (CONF-740115-, pp 8-15) RADIOISOTOPE COMPOSITION OF PLUTONIUM IN THE FUEL CYCLE. Litkala, R. C. (Battelle Pacific Northwest Labs., Richland, WA). Dec 1974.

From plutonium information meeting; Los Alamos, New Mexico, USA (4 Jan 1974).

In plutonium information meeting.

The nuclear fuel cycle from the uranium mine to the ultimate disposal of radioactive wastes is discussed with emphasis on the changing content of ^{236}Pu, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Pu, and ^{242}Pu at various stages during the fuel cycle. It is pointed out that ^{236}Pu and ^{240}Pu are basically in equilibrium, a continuing buildup of ^{238}Pu occurs and a continual degradation of ^{239}Pu occurs, and a continual degradation of the fissile content of Pu occurs. The principal sources of radiation hazards in the fuel fabrication line are neutron emission from ^{238}Pu and γ emission from ^{236}Pu. Fuel fabrication, fuel management practices, and fuel reprocessing aspects of the fuel cycle are discussed. Projections are made for the cumulative inventory of Pu to the year 1985. Typical core arrangements in a boiling water reactor (BWR) and a pressurized-water reactor (PWR) are discussed in relation to the content of various Pu isotopes in spent fuel elements. The radioisotope composition of Pu in the fuel cycle of various types of reactors are compared and the impact of the operation of the liquid metal fast breeder reactor (LMFBR) and changing industrial practices of Pu recovery at the reprocessing step are postulated. (CH)

13774 (COO-3521-125) BIOLOGICAL EFFECTS OF RADIATION AND RELATED BIOCHEMICAL AND PHYSICAL STUDIES. Proposal 4. Cyclotron Facility and Radionuclide Production. Progress Report, May 1, 1970–May 1, 1971. Laughlin, J. S.; Tilbury, R. S.; Kuo, T. Y. T. (Sloan-Kettering Inst. for Cancer Research, New York (USA)). 1971. Contract AT(30-1)-910. 31p. Dep. NTIS $4.75.

Methods are described that were used for the preparation of various compounds labeled with short-lived cyclotron-produced ^{11}C, ^{18}F, ^{52}Fe, ^{13}N, or ^{30}P for use in medical studies. Modifications in the cyclotron to improve efficiency for the production of radionuclides are reported. (CH)

13775 (ORNL-tr-2828) PREPARATION OF AMERICIUM IN HEPTAVALENT STATE. Krot, N. N.; Shilov, V. P.; Nikolaevskii, V. B.; Nikaev, A. K.; Gel'man, A. D. Translated by Martha Gerrard from Dokl. Akad. Nauk SSSR; 217: No. 3, 589-592(1974). 8p. Dep. NTIS (US Sales Only) $4.00.

The preliminary studies on the oxidation of Am(VI) to the heptavalent form were carried out in 3M NaOH solutions at 0°C, supersaturated with N_2O, and γ irradiated to produce the O^- ion-radical as the oxidizing reagent. The irradiated samples changed from the original light yellow to a greenish shade with an optical density in the 370 to 450 nm range twice that of the original solution. The color faded with time. The passage of ozonized air through NaOH solutions of Am(VI) resulted in the same color change. Stoichiometric oxidations of Pu(VI) and Np(VI) by Am(VII) in 1 to 2M NaOH were observed and confirmed the formation of the heptavalent Am. (JSR)

13776 CHEMISTRY OF URANIUM HEXACHLORIDE AND URANIUM PENTACHLORIDE AZIDE. Kolitsch, W.; Mueller, U. (Univ., Marburg, Ger.). Z. Anorg. Allg. Chem.; 410: No. 1, 21-31(Nov 1974). (In German).

UCl_6, for which an improved method of preparation is given, can be reduced with chloride ions to give hexachlorouranate(V) and with solvents containing hydrogen such as H_2CCl_2 to give uranium pentachloride. With chlorine azide the uranium chloride azides UCl_5N_3 and $UCl_4(N_3)_2$ are formed, but they can only be obtained in low yields as a mixture because of their reactivity towards the solvent used. With H_2CCl_2 or 1,2-dichloroethane as solvent, NH_4UCl_6 is the main product; with CCl_4 as solvent, the triazidocarbenium salt $[C(N_3)_3]UCl_6$ is formed with high yield. Intermediates of the reaction path to these products could be identified

by ir spectroscopy. The infrared spectra of UCl_5N_3 and $UCl_4(N_3)_2$ are reported and data about the crystal structure of $[C(N_3)_3]UCl_6$ are given. (auth)

13777 CRYSTAL STRUCTURE OF A TRICLINIC MODIFICATION OF URANIUM PENTACHLORIDE. Mueller, U.; Kolitsch, W. (Univ., Marburg, Ger.). Z. Anorg. Allg. Chem.; 410: No. 1, 32-38(Nov 1974). (In German).

From solution uranium pentachloride crystallizes at room temperature in a triclinic modification belonging to the space group $P\bar{1}$. The unit cell contains one formula unit $(UCl_5)_2$ and has the dimensions a = 707, b = 965, c = 635 pm and $\alpha = 0.495\ \pi$, $\beta = 0.652\ \pi$, $\gamma = 0.603\ \pi$ rad. The crystal structure was solved with the aid of x-ray diffraction data and was refined to a reliability index of R = 0.082. The structure consists of $(UCl_5)_2$ molecules having the point symmetry mmm in which the uranium atoms are linked with one another via two chlorine atoms. The crystal lattice can be derived from a hexagonal closest packing of chlorine atoms in which 1/8 of all octahedral holes are occupied by uranium atoms. (auth)

13778 COMPOUNDS OF THORIUM WITH NITROGEN AND HYDROGEN. Blunck, H.; Juza, R. (Christian Albrechts Univ., Kiel). Z. Anorg. Allg. Chem.; 410: No. 1, 9-20(Nov 1974). (In German).

$ThN(NH_2)$ was prepared by reaction of ThNI with alkali amide in liquid (20°C) or supercritical NH_3 (300°C, 4000 atm). It is brown, easily hydrolyzed, and of bad crystallization. In the same way $Th_3N_2(NH)_3$ was prepared at 350°C. $Th(NH)_2$ was prepared by reaction of Th metal with NH_3 (325°C, 6000 atm) in the presence of some alkali amides. It is extremely hydrolyzable and crystallizes in the structure of α-Th_3N_4 with unoccupied ThI positions. A hydride nitride, $ThHN_{1-2}$, an interstitial compound with cubic face-centered Th lattice, was found. (auth)

13779 $Ba_2Sm_{0.67(1-x)}La_{0.67x}UO_6$. Schittenhelm, H. J.; Kemmler-Sack, S. Lab. for Inorganic and Analytic Chemistry, Tuebingen, Ger.). Z. Anorg. Allg. Chem.; 410: No. 1, 39-47 (Nov 1974). (In German).

In the $Ba_2Sm_{0.67(1-x)}La_{0.67x}UO_6$ system the boundary of the perovskite phase reaches up to x ≅ 0.33. With increasing lanthanum content a transition from a structure with vacancies in the SE^{3+}-sublattice to a lattice type with interstitial oxygen is observed. By the interpretation of the reflectance and vibrational spectra the relations between colour and constitution are shown. (auth)

13780 EQUILIBRIUM OF $PbCl_{2,g}$ + $ThCl_{4,g}$ IN EQUILIBRIUM $PbThCl_{6,g}$ AND THE VAPOR PRESSURES OF $PbCl_2$ AND $ThCl_4$. Binnewies, M.; Schaefer, H. (Univ., Muenster, Ger.). Z. Anorg. Allg. Chem.; 410: No. 2, 149-155(Nov 1974). (In German).

The equilibrium $PbCl_{2,g}$ + $ThCl_{4,g}$ = $PbThCl_{6,g}$ was measured by means of the Knudsen effusion method combined with a mass spectrometer. Using $\Delta S°(298) = -36$ e.u. and $\Delta Cp = 4$ cal/°, mol the result is $\Delta H°(298) = -32.0$ kcal/mol. The vapor pressures of $PbCl_{2,g}$ and $ThCl_{4,g}$ were also measured and are discussed in relation to literature data. For the sublimation of $ThCl_4$ $\Delta H°(298) = 49.26$ kcal; $\Delta S°(298) = 45.40$ cl; $\log P(ThCl_4) = -11068/T + 16.2253 - 0.0003606\ T - 2.0936 \log T$ between 298 and 1043°K atmospheric pressure. (auth)

13781 DECONTAMINABILITY OF CERTAIN PAINTS CONTAINING ^{237}Np, ^{241}Am, ^{242}Cm, AND ^{244}Cm. Tsameryan, I. I.; Gol'dshtein, D. S.; Atamanova, E. I. At. Energ. (USSR); 37: No. 5, 390-392(Nov 1974). (In Russian).

The decontaminability of certain paints based on resin SVH-40, mixtures of post-chlorinated poly(vinyl chloride) and alkyd resins, pentaphthalic resin PFL-64, and chlorosulfurized polyethylene containing ^{237}Np, ^{241}Am, and $^{242,244}Cm$ was studied. Samples of paints applied to metallic plates were contaminated with 1 N nitrate solutions of all the indicated isotopes and also with nitrate solutions of ^{241}Am and $^{242,244}Cm$ at pH ~3. The samples were decontaminated at first with a solution containing 5% Na_2CO_3 + 0.1% $KMnO_4$ + 0.4% $(NaPO_3)_6$ and then with 0.3 N $H_2C_2O_4$ + 0.2% NaF + 0.5% of the detergent "Novost". A "contamination-washing" cycle was repeated five times. The highest decontaminability of 10 tested paints was found in HS-76 lacquer (CVH-40 resin solution in a mixture of organic solvents). Neptunium is significantly more difficult to remove from paints than americium and curium, especially from paints based on epoxy resins. The decontaminability of certain paints decreases with increasing acidity of contaminating solutions. Lacquer HS-76 is recommended as an outer layer of protective coating when working with Np, Am and Cm. Its initial contamination can be reduced by decontamination by as much as 500 to 1,000 times. (auth)

13782 SALTS OF ANTHRANILIC ACIDS AND O-TERTIARY-ARSINOBENZOIC ACIDS WITH URANYL ION. Sandhu, S. S.; Aulakh, G. S. (Guru Nanak Univ., Amritsar, India). pp 169-177 of Proceedings of the Chemistry Symposium. Vol. II. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P2.

Salts of uranyl ion with anthranilic acid, N-methylanthranilic acid, 5-chloroanthranilic acid, and o-tertiaryarsinobenzoic acids were prepared and studied to determine the nature of bonding in these compounds. (LK)

13783 COMPLEXES OF URANYL β-DIKETONATES WITH METHYL SUBSTITUTED PYRIDINE N-OXIDES. Manchanda, V. K.; Subramanian, M. S. (Bhabha Atomic Research Centre, Bombay). pp 179-184 of Proceedings of the Chemistry Symposium. Vol. II. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P2.

In connection with synergistic studies on uranyl systems, several complexes of methyl-substituted pyridine N-oxides with uranyl β-diketonates were isolated, and the strength of the metal-oxygen bond (donor) was investigated using infrared and proton magnetic resonance studies. (LK)

13784 SOLUBILITY OF PLUTONIUM TRIFLUORIDE IN MOLTEN MIXTURES OF LITHIUM, BERYLLIUM, AND THORIUM FLUORIDES. pp 291-299 of Proceedings of the Chemistry Symposium. Vol. II. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P2.

Results of studies on the solubility of PuF_3 in binary mixtures of $LiF-ThF_4$ and ternary mixtures of $LiF-BeF_2-ThF_4$ in the range 500-800°C are summarized. (LK)

13785 X-RAY AND THERMAL INVESTIGATIONS OF AMMONIUM, SODIUM, AND POTASSIUM URANYL ACETATES. Awasthi, S. K.; Chawla, K. L.; Chackraburtty, D. M. (Bhabha Atomic Research Centre, Bombay). pp 347-353 of Proceedings of the Chemistry Symposium. Vol. II. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P2.

Preparation, thermal decomposition, and infrared and x-ray data on ammonium, sodium, and potassium uranyl acetates are described. (LK)

13786 ISOLATION AND CHARACTERIZATION OF THALLIUM(I) TRISCARBONATODIOXOURANATE(VI) AND ITS THERMAL BEHAVIOR. Giridharan, A. S.; Udupa, M. R.; Aravamudan, G. (Indian Inst. of Tech., Madras). pp 355-364 of Proceedings of the Chemistry Symposium. Vol. II. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P2.

The triscarbanate complex of dioxouranium(VI) featuring thallium(I) as the cation was prepared and characterized by x-ray and IR spectral studies. The thermal behavior of the compound was investigated under diverse conditions. (LK)

13787 X-RAY AND THERMAL INVESTIGATIONS ON THALLIUM URANYL OXALATES. Jayadevan, N. C.; Dias, R. M. A.; Chackraburtty, D. M. (Bhabha Atomic Research Centre, Bombay). pp 365-371 of Proceedings of the Chemistry Symposium. Vol. II. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P2.

Thallium uranyl oxalates $[Tl_2(UO_2)_2(C_2O_4)_3$ and $Tl_4UO_2(C_2O_4)_3]$ were prepared and their thermal behavior was studied. There is no evidence of the formation of the triuranate in the Tl-U-O system in the thermal decomposition of the thallium uranyl oxalates. The diuranate is the stablest oxide of the system up to 125°C and is best prepared from $Tl_2(UO_2)_2(C_2O_4)_3$ at 300°C. (LK)

13788 ALTERNATIVE MODEL FOR NONSTOICHIOMETRY IN URANIUM HYDRIDE. Condon, J. B. (Union Carbide Nuclear Corp., Oak Ridge, TN). J. Phys. Chem.; 79: No. 1, 42-48(2 Jan 1975).

A model is presented to account for the nonstoichiometry and observed hydrogen overpressures for uranium hydride. The model assumes that vacancies in the hydrogen lattice are disfavored when the hydride is contaminated by oxygen and favored when certain metallic contaminants are present. This model explains the literature data as well as, if not better than, the

model involving vacancy-vacancy attractions. It is also better than the pure vacancy model. The presented model accounts for the observed hysteresis in the hydrogen pressure over uranium hydride and explains the first-order kinetics in uranium observed for hydriding. (auth)

13789 URANYL HALIDE SPECIES SORBED ON ION EXCHANGERS. Heitner-Wirguin, C.; Gantz, M. (Hebrew Univ., Jerusalem). Israel J. Chem.; 12: No. 3, 723-728(Nov 1974).

Uranyl ions were sorbed on a cation and anion exchanger from fluoride, chloride, and bromide solutions. The visible and ir spectra of the sorbed species were recorded. The species identified were $UO_2F_3^-$, UO_2Cl^+, $UO_2Cl_3^-$ and $UO_2Cl_4^{2-}$, UO_2Br^+ and $UO_2Br_3^{2-}$. Analysis of the spectra obtained made possible the determination of the coordination number and the symmetry of the species, i.e., the cationic species have the coordination number six, while the anionic species have the coordination number four. (auth)

13790 COVALENT BONDING IN LANTHANIDE TRIHALIDES. Myers, C. E. (State Univ. of New York, Binghamton). Inorg. Chem.; 14: No. 1, 199-201(Jan 1975).

An appropriate model for bonding in the lanthanide trihalide molecules should account for the bond strength of these molecules. Thermodynamic and spectral data in the literature provide a basis for calculations testing the ionic model and assessing whether a covalent model may be appropriate. The approach used here is to calculate atomization energies of the molecules and to apply first an ionic model and then a covalent model in an attempt to account for observed trends, these models being considered the only reasonable ones for these molecules. From the results of the study it is concluded that a covalent model involving d^2s hybrid orbitals on the lanthanide provides a better basis for understanding the thermochemical atomization energies of the lanthanide trihalides than does the ionic model. (LK)

13791 ORGANOACTINIDES AND ORGANOLANTHANIDES. XII. Bimetallic Tris(Cyclopentadienyl)Uranium Derivatives With Uranium-Carbon Sigma Bonds. Tsutsui, M.; Ely, N.; Gebala, A. (Texas A and M Univ., College Station). Inorg. Chem.; 14: No. 1, 78-81(Jan 1975).

New σ-bonded organouranium complexes of the type Cp_3U-R ($Cp = \eta^5-C_5H_5$; R = acetylide, ferrocenyl) and $(Cp_3U)_2-R$ (R = ferrocenyl, p-phenyl) have been prepared from Cp_3U-Cl and the respective RLi, RNa, or RLi_2 reagents in THF. The ferrocenyl complexes are the first σ-bonded organoactinide compounds where the R group is an organometallic moiety and the $(Cp_3U)_2-R$ complexes are the only organometallics known to contain two organoactinide moieties bound to the same R group. Infrared and proton nmr spectra support the presence of the R groups as being σ bonded. A mechanism based on large contact effects is used to explain the large isotropic shifts in the nmr spectra. All of the complexes have marked thermal stability and a mass spectrum of the Cp_3U-ferrocene derivative is reported. Magnetic susceptibility studies at various temperatures indicate enhanced spin-spin interactions present in the $(Cp_3U)_2-R$ complexes which are absent in their Cp_3U-R analogs. Other differences between the Cp^3U-R complexes and their "dimeric" analogs are noted. (auth)

13792 MEASUREMENT OF STANDARD POTENTIALS OF THE SYSTEM Am(III)/Am(0) IN THE EUTECTIC LiCl-KCl WITHIN THE RANGE 400 TO 600°C. Martinot, L. (Liege Univ.); Spirlet, J. C.; Duyckaerts, G.; Muller, W. Bull. Soc. Chim. Belg.; 83: No. 11-12, 449-455(1974). (In French).

Standard potentials of the system Am(III)/Am(0) were measured in the molten LiCl-KCl eutectic within the temperature range 400 to 600°C. The cell used was the following: Am/Am(III), LiCl-KCl/Ag(I), LiCl-KCl/Ag. A comparison was made with previous results obtained for actinides and lanthanides. (auth)

13793 TRITIUM-LABELLED ELLIPTICINE DERIVATIVES. Le Goffic, F.; Gouyette, A. (Ecole Normale Superieure, Paris). Compt. Rend., Ser. C; 279: No. 1, 47-48(1 Jul 1974). (In French).

In methanol containing tritiated water, ellipticine salts (pyridiniums) and derivatives are reduced by tritiated sodium borohydride after the usual treatments (hydrogenolysis and aromatisation) the initial products are regenerated with a good total yield, tritium-labelled on carbons 1, 3, and 4. (FR)

13794 AQUEOUS CHEMISTRY OF PROTACTINIUM(IV). IV. Complex Formation Between Pa(IV) and EDTA. Lundqvist, R.; Andersson, J. E. (Chalmers Tekniska Hoegskola, Goteborg). Acta Chem. Scand.; 28: No. 6, 700-702(1974).

13795 DISSOCIATION AND SOLVATION OF URANYL COMPOUNDS IN WATER-ORGANIC SOLVENTS. I. Investigations of Uranyl Sulfate in Water-Dioxane Mixtures by Conductivity. Ernst, S.; Jezowska-Trzebitowska, B. (Univ., Wroclaw). Z. Phys. Chem. (Leipzig); 255: No. 4, 801-807(1974).

The measured conductivities of uranyl sulfate in water-dioxane mixtures containing 20, 45, 70, and 82 wt.% of the organic component are reported. The influence of the solvent structure on the conductivity of uranyl sulfate in the mixed solvents is discussed and the association constants of uranyl sulfate calculated. Also, some conclusions about the structure of associates formed by uranyl sulfate in the investigated solvent systems are drawn. (auth)

13796 NEPTUNIUM-MOLYBDENUM HETEROPOLYACID. Torchenkova, E. A.; Golubev, A. M.; Saprykin, A. S.; Krot, N. N.; Spitsyn, V. I. (Moscow State Univ.). Dokl. Chem.; 216: No. 4-6, 430-433(Jun 1974).

Translated from Dokl. Akad. Nauk SSSR; 216: No. 5, 1073-1076 (Jun 1974).

A white rosy-tinged precipitate of neptunium-molybdic acid (NMA) was prepared by the reaction of ammonium paramolybdate and neptunium(IV) ammonium hexanitrate. A chemical analysis of the precipitate gave the formula $H_8[NpMo_{12}O_{42}] \cdot 18H_2O$. The ir spectrum of crystalline NMA almost completely coincides with the absorption bands of uranomolybdic acid. The uv spectrum of an aqueous solution of NMA is not constant with time as the absorption intensity increases. The energies of the electron transition in the absorption spectrum in the visible region coincide with the calculated values of the transitions of free Np(IV) ions. An analysis of the neutralization curve of solutions showed that NMA is octabasic and behaves as a strong tribasic acid. The anion is stable in a broad pH range. PMR studies showed that the formula of the octadecahydrate of NMA can be represented as $(H_3O)_5H_3[NpMo_{12}O_{42}] \cdot 13H_2O$. NMA can be considered as a new representative of the class of heteropolycomplexes with icosahedral surroundings of the central atom. (JSR)

13797 PREPARATION OF RADIOACTIVE PREPARATIONS. VIII. Preparation of Inulin Labelled with Iodine Radioisotopes. Stanko, V. I.; Shavratskii, V. Kh.; Malinina, T. G.; Kulakov, V. N. (Inst. of Biophysics, Moscow). Isotopenpraxis; 10: No. 7, 259-262(Jul 1974). (In Russian).

A method for the modification of the phenol groups of inulin was developed. The inulin obtained by this method was iodinated chemically or electrochemically. Aromatic C-I bonds were formed with the radioisotope. These bonds had a high hydrolytic stability. The behavior of the inulin modified by 1 to 3 molecules of salicylic acid, under conditions of gel filtration, is practically the same as the behavior of the original inulin. (tr-auth)

13798 PRODUCTION OF HIPPURAN-^{131}I AT BORIS KIDRIC INSTITUTE, VINCA. I. The Production Process and New Cell. Draskovic, R. J.; Ratkovic, M.; Draskovic, R. S. (Boris Kidric Inst. of Nuclear Sciences, Vinca, Yugoslavia). Isotopenpraxis; 10: No. 7, 262-265(Jul 1974).

In the Laboratory for Chemistry and Production of Radioisotopes of Boris Kidrič Institute, a new cell for production of hippuran-^{131}I is constructed, into which the following devices are built: a drying chamber (isotope exchange process), a centrifugal machine (separation process), the devices for adjustment of pH, reagent-adding (KI, NaOH, and HCl) for distribution of hippuran-^{131}I into penicilline vials, for capsuling and decapsuling of the vials, corresponding shielding, manipulators and the box for effluents. This radiopharmaceutical is produced at BKI according to the modified Meier-Borst's process. The yield varied from 75 to 85% and the carrier concentration was about 0.25 mCi/mg of non-radioactive hippuran. (auth)

13799 NEW METHOD FOR THE PREPARATION OF RADIOACTIVE COLLOIDAL SOLUTIONS. Mikheev, N. B. (Inst. of Physical Chemistry, Moscow). Isotopenpraxis; 10: No. 7, 275-277(Jul 1974). (In Russian).

A method was developed for the preparation of radioactive colloidal solution in which an emulsion of the extracting agent was prepared. The extracting agent is recovered in an organic disperse phase of radioactive isotopes. The organic phase is concentrated and as a result the emulsion is transformed into a colloidal solution or suspension in which the radioactive isotopes are located. The detailed steps of this method using ethyl alcohol as the organic phase were outlined. The method is suitable for preparing colloidal solutions with ^{32}P or ^{99m}Tc. (JSR)

13800 CONSTITUENT ANALYSIS OF THE POTENTIAL GRADIENT ALONG A REACTION COORDINATE. Method and An Application to CH_4 + T Reaction. Fukui, K.; Kato, S.; Fujimoto, H. (Kyoto Univ.). J. Amer. Chem. Soc.; 97: No. 1, 1-7(8 Jan 1975).

On the basis of a formulation of the chemical reaction coordinate previously proposed the nuclear displacement on the reaction coordinate is discussed in terms of the potential energy gradient,

which is determined by the aid of the Hellmann–Feynman theorem from the electron density distribution and the nuclear arrangement of the total reacting system. The electron density is partitioned into several physically significant terms including exchange, delocalization, and polarization densities by the use of configuration interaction procedure, so that the potential gradient is also divided into the corresponding terms to discuss the origin of the favorableness or unfavorableness of a reaction path. An application is made to the methane–tritium reaction by the employment of an ab initio unrestricted Hartree–Fock molecular orbital method. Theoretical information is obtained with regard to submolecular mechanisms of the reaction. (auth)

13801 SYNTHESIS, VIBRATIONAL SPECTRA, AND PROTON MAGNETIC RESONANCE OF SOME BORON-SUBSTITUTED TRIS(CYCLOPENTADIENYL)URANIUM(IV) TETRAHYDROBORATES. Marks, T. J.; Kolb, J. R. (Northwestern Univ., Evanston, IL). J. Amer. Chem. Soc.; 97: No. 1, 27-33(8 Jan 1975).

The reaction of $(C_5H_5)_3UBH_4$ with R_3B yields the corresponding $(C_5H_5)_3UH_3BR$ compound, R = C_2H_5, C_6H_5. Vibrational spectra indicate that the BR group is connected to uranium via a triple hydrogen bridge. The compounds $(C_5H_5)_3UNCBH_3$ and $(C_5H_5)_3UNCB(C_6H_5)_3$ were synthesized by the reaction of $(C_5H_5)_3UCl$ with the corresponding anionic borates. Vibrational spectra suggest the metal–borate linkage is of the type UN ≡ CB|←. Large isotropic shifts were observed in the PMR spectra of these paramagnetic U(IV) compounds. For the $(C_5H_5)_3UH_3BR$ system it was possible to separate contact and dipolar contributions; the mechanism of unpaired spin distribution involves negative spin density on the protons bound directly to uranium. The ^{11}B-decoupled PMR spectrum of the fluxional molecule $(C_5H_5)_3UBH_4$ exhibits collapse of the BH_4 resonance at low temperatures. This indicates that the paramagnetism induces sufficient energy separation between exchanging sites (bridge and terminal hydrogens) to observe, for the first time in a metal tetrahydroborate, slowing of the dynamic intramolecular rearrangement process. At the estimated coalescence point (−140 ± 20°) $\delta\omega$ = 15,000 to 36,000 Hz and $\Delta G^{\ddagger} \approx 5.0 \pm 0.6$ kcal/mol. (auth)

Radioactive Waste Treatment

Refer also to abstract 15744.

13802 (CONF-741026-8) USE OF CRYOGENIC GRINDING AND LEACHING TO REDUCE THE VOLUME AND ACTIVITY OF SOLID WASTES CONTAMINATED BY ALPHA-ACTIVE MATERIALS. Ganivet, M.; Cousinou, G. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France)). 1974. Translated from Conference on the Control of Plutonium-Contaminated Solid Wastes, Marcoule, October 14–16, 1974. 9p. Dep. NTIS $4.00.

From seminar on the management of plutonium-contaminated solid wastes; Marcoule, France (14 Oct 1974).

A method is proposed for the treatment of Pu-contaminated solid wastes; it involves a large reduction of the volume accompanied by the removal of most of the alpha activity. The first step consists of the cryogenic grinding at 70°C; in a second step, the ground wastes are leached successively by citric acid for removing ionic forms of plutonium and by a detergent for removing powdered plutonium oxide. After this treatment, the wastes are dried, compacted, checked for residual plutonium content, and stored. The volume is reduced by nearly a factor of 10. The detergent solution is recycled after separation of the powder; the plutonium extracted from wastes by citric acid is recovered. (auth)

13803 (CONF-741026-9) MARCOULE INCINERATOR FOR WASTES CONTAINING LARGE AMOUNTS OF ALPHA EMITTERS. Soulier, H. (CEA Centre de Marcoule, 30 – Bagnols-sur-Ceze (France)). 1974. Translated from Conference on the Control of Plutonium-Contaminated Solid Wastes, Marcoule, October 14–16, 1974. 14p. Dep. NTIS $4.00.

From seminar on the management of plutonium-contaminated solid wastes; Marcoule, France (14 Oct 1974).

The main operating conditions are described, specifying the composition of the incinerated wastes, the amount and the composition of the ashes, and the main difficulties encountered during the operation. It is possible to recover the fissionable materials from the ashes; the procedure is briefly described. The results of two years of operation with radioactive feed confirm the technical and economical advantages of this type of process, i.e., the reduction of the volume of wastes and the potential recovery of the fissionable materials, if the unit has an adequate throughput. In the after-burning region, the temperature varies from 950 to 1100°C depending on the zone. It would be desirable to have sufficient electric power to obtain temperatures of 1100°C or higher in all zones. The ashes are spread out on the ground every eight hours and are removed by means of a rabble twice a week. The hot gases are diluted with 115 m^3/hour of air, thus obtaining a temperature of 300°C. After passage through the cooling coil, this temperature is brought down to 55°C. The coil is sprayed after every 300 hours of operation. The primary filter in the gas exhaust circuit is changed whenever its clogging prevents the close adjustment of the pressure reduction within the furnace. (auth)

13804 (ORNL-5012) FEASIBILITY STUDIES OF THE PARTITIONING OF COMMERCIAL HIGH-LEVEL WASTES GENERATED IN SPENT NUCLEAR FUEL REPROCESSING. Annual Progress Report for FY-1974. Bond, W. D.; Leuze, R. E. (Oak Ridge National Lab., Tenn. (USA)). Jan 1975. Contract W-7405-eng-26. 111p. Dep. NTIS $5.45.

The feasibility of removing long-lived actinides from high-level waste has been evaluated on a preliminary basis. Results indicate that it may be possible to remove actinides to a sufficiently low level to decrease the potential hazard of high-level waste at 1000 years to a value comparable to that of naturally occurring uranium minerals. The feasibility study was directed primarily at high-level waste generated by the commercial reprocessing of LWR fuel. Although certain separations processes have the potential for the necessary actinide removals (up to 10^4 on a spent-fuel basis), they have not been applied to the particular problem of separations from waste solutions. A research and development program of considerable depth is required to determine whether these separations processes can be successfully modified and adapted to achieve the necessary separations and, in turn, be integrated into a functional waste processing facility at the expected levels of radioactivity. Data obtained in studies carried out thus far indicate that the most promising concept for achieving the desired removals of actinides will require improved recovery of actinides in conventional reprocessing of fuels as well as secondary processing of the waste. Potential processes for the necessary actinide removals were studied, and several problems that must be solved to develop satisfactory process flowsheets were identified. Present laboratory studies are designed to pinpoint the advantages of various promising potential processes and to resolve some of the difficult chemical problems. (auth)

13805 (RFP-2181) INVESTIGATION OF THE CARBON TETRACHLORIDE–METHANOL–PLUTONIUM METAL SYSTEM. Crisler, L. R. (Dow Chemical U. S. A., Golden, Colo. Rocky Flats Div.). 6 Dec 1974. Contract AT(29-1)-1106. 34p. Dep. NTIS $4.00.

A number of reaction parameters needed to evaluate the feasibility of using the dissolution reaction system, carbon tetrachloride–methyl alcohol–plutonium metal, for plutonium recovery efforts were studied. Reaction rates of approximately 13 [(mg/cm^2)/min] and 0.14 (moles gas/mole Pu dissolved) at ambient conditions for metal dissolution and reaction off-gassing were determined. The dissolution rate was diminished to approximately 2 [(mg/cm^2)/min] at −26°C. The heat of reaction for this dissolution was experimentally determined to be $\Delta H = -205$ (kcal/mole Pu consumed). The reaction-induction period normally noted for this reaction system can be altered by adding small amounts of stimulating agents. Organic compounds containing β-diketone functional groups were shown to reduce the reaction-induction period to near zero. A number of potential reaction mechanisms are discussed based on a review of the chemistry involved for the reactants. (auth)

13806 EXTRACTION OF AMERICIUM, CURIUM, STRONTIUM, AND RARE-EARTH ELEMENTS FROM RESIDUAL AQUEOUS SOLUTIONS OBTAINED IN REPROCESSING SPENT FUEL ELEMENTS OF WATER-MODERATED WATER-COOLED POWER REACTORS. Shevchenko, V. B.; Smelov, V. S.; Kozlov, A. G.; Chubukov, V. V.; Lanin, V. P.; Smetanin, E. Ya. At. Energ. (USSR); 37: No. 5, 379-383(Nov 1974). (In Russian).

Conditions providing quantitative extraction of strontium, americium, curium, and rare earth elements from an aqueous solution are examined theoretically along with the regimes of fractional separation of these elements in re-extraction operations using diethyl phosphoric acid. The successful practical application of the devised regimes is illustrated by the extraction and separation of strontium, americium, curium, and rare earth elements from residual aqueous solutions obtained in regenerating spent fuel elements of water-moderated water-cooled power reactors. (auth)

13807 TREATMENT OF WASTE MATERIALS GENERATED IN THE CONVERSION OF UF_6 TO UO_2 BY THE AUO ROUTE. Muller, H.; Pirk, H.; Hackstein, K. (to Nukem GmbH). US Patent 3,842,155. 15 Oct 1974. Priority Date 23 Apr 1969, F.R. Germany. 8p.

As shown in the drawings, NH_3, CO_2, uranium, and fluorine, the latter either in the form of ammonium hydrogen fluoride or in the form of calcium fluoride, are recovered from NH_4^+, carbonate, uranium and fluoride containing waste water from the precipitation of uranium from UF_6 in aqueous solution as tetraammonium uranyl tricarbonate and condensed, NH_3 and CO_2 containing waste gases from the decomposition of tetraammonium uranyl tricarbonate by employing a circulatory process having a first phase in which the two waste solutions are reacted with a strongly acid solution of ammonium fluoride and ammonium hydrogen fluoride to liberate carbon dioxide and bind ammonia and a second phase wherein the resulting weakly acid carbonate free solution is partly evaporated to set free ammonia and regenerate the strongly acid solution and a part stream of the acid solution is withdrawn from the CO_2-liberating circuit to maintain the fluorine content of the circuit constant and the uranium is recovered by precipitating it from the said part stream with ammonia and hydrogen peroxide, whereafter the remaining solution is freed of fluorine by precipitating the latter as an insoluble fluoride. (Official Gazette)

Radioisotope Production

Refer also to abstract 13705.

13808 (IAEA-R-1000-F) DEVELOPMENT OF RAPID CHEMICAL AND RADIOCHEMICAL PROCEDURES FOR PREPARATION AND CONTROL OF VERY SHORT-LIVED RADIOISOTOPES AND THEIR LABELLED COMPOUNDS. Part of a Coordinated Program on Radiopharmaceuticals. Final Report. Iya, V. K. (International Atomic Energy Agency, Vienna (Austria)). Jun 1974. 37p. INIS.

Different methods for radiochemical separation of ^{99m}Tc from ^{99}Mo were investigated including: (1) adsorption of ^{99}Mo on acidic alumina column and elution of ^{99m}Tc with different solutions; (2) sublimation of Tc_2O_7; (3) solvent extraction of ^{99m}Tc with MBK. The adsorption of $^{113}Sn(IV)$ in hydrous zirconium oxide was studied. Studies on the separation of ^{113m}In from adsorbed ^{113}Sn in hydrous zirconium oxide were also performed. A semi-automated solvent extraction generator has been developed for use in hospitals and small research centers. A new method for the preparation of ^{113m}In was developed in which the ^{113}Sn is loaded in a hydrous zirconium oxide column from concentrated NaCl solution. The new generator works satisfactorily over eight months showing that ^{113}Sn and zirconium contaminants are much below the permissible levels. Procedures for the preparation and control of ^{99m}Tc sulfur colloid, ^{99m}Tc human serum albumin, ^{99m}Tc phytate, ^{99m}Tc glucoheptonate, ^{99m}Tc pyrophosphate, ^{113m}In DTPA, and ^{113m}In gelatin have been standardized by the authors. (INIS)

13809 (INIS-mf-1285) RADIOISOTOPE PRODUCTION PLANT. Flores E, R. M. (Instituto Politecnico Nacional, Mexico City. Escuela Superior de Ingenieria Quimica e Industrias Extractivas). 1973. 160p. (In Spanish). INIS.

Thesis.

A critical study is made of the design, construction, and operation of a plant for radioisotope processing. From an analysis of the market for the most-used radioisotopes in Mexico City production possibilities and limitations using the Triga Mark III reactor were established. Because of the development of new techniques in the processing of radioisotopes and from an economic evaluation, an average capacity industrial plant was constructed. The plant consists of a series of shielded cells placed next to each other. A steel structure which supports both the cells and the shielding for the cells was installed. The design of the cells allows remote control across a 10-cm thick Pb shield. Each cell is provided with an individual system of utilities, which are fed by general lines throughout the plant. The control of the utilities is done outside the cells by valves which are located at a control desk and provide cold, demineralized, and hot water, air, and vacuum to each cell as desired. There is another control desk for the electrical systems providing illumination and current to the interior of the cells and for the control of an electrical pneumatic system in each cell for transfer of materials between the cells. There are other installations for the injection and extraction of air and for the drainage of liquid radioactive wastes to a location outside the plant. (tr-auth)

13810 (JINR-6-7469) METHODS FOR PRODUCTION OF SHORT-LIVED SEPARATED ISOTOPES OF RARE-EARTH ELEMENTS. Lyatushinski, A.; Zhuk, V.; Zuber, Ya.; Zuber, K.; Potempa, A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1973. 23p. (In Russian). INIS.

A method has been developed for the rapid production of rare earth isobars. A measurement is carried out on the efficiency of rare earth diffusion from a tantalum target as a function of time and temperature. The separation efficiency is measured under various operating conditions. 19 refs. (INIS)

13811 (LBL-2834) PRODUCTION OF RADIOISOTOPES FOR USE IN NUCLEAR MEDICINE. Yano, Y.; Chu, P.; Hemphill, W. P.; Larimer, R. M.; Harrington, H. J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Nov 1974. Contract W-7405-eng-48. 24p. (CONF-741221-3). Dep. NTIS $4.25.

From 3rd interamerican meeting on radiochemistry; Sao Paulo, Brazil (2 Dec 1974).

Production of ^{18}F, ^{52}Fe, ^{81}Rb, ^{81m}Kr, ^{82}Sr, ^{82}Rb, ^{117}Sb, ^{123}I, ^{123}Xe, ^{129}Cs, ^{157}Dy, ^{167}Tm, ^{117m}Sn, ^{191}Os, and ^{191m}Ir and their uses in nuclear medicine are discussed. (LK)

13812 (SGAE-2299) HEALTH PHYSICS TESTING OF ^{99}Mo-^{99m}Tc GENERATORS. Sorantin, H.; Strachotinsky, C.; Krejsa, P. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Strahlenschutz). Oct 1974. 36p. (In German). (ST-28/74). Dep. NTIS (US Sales Only) $5.00.

The production of $^{99}Mo/Tc$ generators by separation of ^{99}Mo from fission product solutions or by neutron activation of Mo is briefly described. A discussion of the radioactive impurities follows and it is shown by gamma ray spectra that in generators containing fission Mo only ^{103}Ru and ^{131}I are present. Otherwise in generators containing activated Mo ^{65}Zn, ^{92}Nb, ^{95}Nb, ^{124}Sb and ^{134}Cs can be found. Using 0.9% sodium chloride solution, only radionuclides with a short half-life like ^{103}Ru (39.5 d) and ^{131}I (8.05 d) are eluted from fission Mo generators, whereas in the eluates of generators with activated Mo only ^{134}Cs (2.1 y) is present. The activities of the different contaminants were determined and the resulting doses in the critical organs were computed. Concurrently the γ shielding of the generators were checked according to the Austrian legal regulations. (auth)

13813 THERMAL SEPARATION OF ^{99m}Tc FROM MOLYBDENUM TRIOXIDE. I. Separation of ^{99m}Tc from Molybdenum Trioxide at Temperatures Below 650°C. Rusek, V. (Univ. of Chemical Tech., Paradubice, Czech.); Vlcek, J.; Machan, V.; Rohacek, J.; Smejkal, Z.; Kokta, L.; Vitkova, J. Radiochem. Radioanal. Lett.; 20: No. 1, 15-22(18 Dec 1974).

Possibilities were examined of separating ^{99m}Tc from molybdenum trioxide at temperatures below 650°C. The sublimation is carried out within the temperature range 400 to 650°C using oxygen as a carrier-gas. The ^{99m}Tc yield was found not to be constant within a given temperature range. A certain degree of stabilization of the yield can be achieved by carrying out the repeated sublimation at higher temperature. The results obtained indicate that, for securing reproducibility of the separation, the temperature should be kept above 650°C. (auth)

13814 THERMAL SEPARATION OF ^{99m}Tc FROM MOLYBDENUM TRIOXIDE. II. Separation of ^{99m}Tc from Molybdenum Trioxide at Temperatures Above 650°C. Vlcek, J. (Regional Hygienic Center, Hradec Kralove, Czech.); Machan, V.; Rusek, V.; Kokta, L.; Rohacek, J.; Smejkal, Z.; Vitkova, J. Radiochem. Radioanal. Lett.; 20: No. 1, 23-31(18 Dec 1974).

Possibilities were examined of separating ^{99m}Tc from molybdenum trioxide at temperature above 650°C. Time-variable temperature and special quartz charge allowing to conduct inner or outer passage of carrier gas was made use of for heating molybdenum trioxide. ^{99m}Tc yields, higher than 60% and constant on repeated separation, were obtained. ^{99}Mo concentration in separated technetium was of the order of 10^{-5}. (auth)

13815 THERMAL SEPARATION OF ^{99m}Tc FROM MOLYBDENUM TRIOXIDE. III. Diffusion Separation of ^{99m}Tc from Molybdenum Trioxide from the Standpoint of Its Possible Use in Technetium Generator. Machan, V. (Safarik Univ., Kosice, Czech.); Vlcek, J.; Kokta, L.; Rusek, V.; Smejkal, Z.; Rohacek, J.; Vitkova, J. Radiochem. Radioanal. Lett.; 20: No. 1, 33-40 (18 Dec 1974).

The paper describes the method of diffusion separation of ^{99m}Tc from molybdenum trioxide without using any carrier gas. The method allows technetium yields to be obtained which are higher than 80% and constant on repeated separation. ^{99}Mo content in the separated technetium is lower than 10^{-7} ^{99m}Tc activity. Possibilities are discussed of using the method of diffusion separation for construction of diffusion technetium generator. (auth)

13816 RADIOACTIVE GAS AND AEROSOL PRODUCTION BY THE CERN HIGH ENERGY ACCELERATORS AND EVALUATION OF THEIR INFLUENCES ON ENVIRONMENTAL PROBLEMS. Peetermans, A.; Baarli, J. (CERN, Geneva). pp 433-448 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear

installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); CONF-731117-(P1).

Nuclear spallation reaction cross-sections for protons on oxygen, nitrogen, and argon are considered. It is shown experimentally that ^{15}O, ^{11}C, ^{13}N, ^{14}O, ^{10}C, and ^{7}Be are the main radioactive elements produced by nuclear reactions of high energy particles on oxygen and nitrogen. The activation of argon in the atmospheric air is the main process to form ^{41}Ar, ^{39}Cl, ^{38}Cl, ^{37}S, ^{32}P, ^{31}Si, ^{28}Al, ^{28}Mg, ^{24}Na, etc. Measured specific activities in air ($\mu Ci/m^3$) are in good agreement with calculations. Computed values for the CERN improved synchro-cyclotron machine are presented. The implications of the release of radioactive gases and aerosols from this high-energy accelerator installation into the environment are discussed, taking into account the available local meteorological data. (auth)

Reactor Fuel Reprocessing

Refer also to abstracts 13702, 14030, 14711, and 15796.

13817 (DOCKET-50201-158) WEST VALLEY REPROCESSING PLANT. Additional Information re Absolute Filters. (Nuclear Fuel Services, Inc., Rockville, Md. (USA)). 25 Nov 1974. 5p. Dep. NTIS $4.00.

Specifications for exhaust filter differential pressure and air filtration equipment are given. (LK)

13818 (DOCKET-50201-159) WEST VALLEY REPROCESSING PLANT. Quarterly Report for July 1, 1974 Through September 30, 1974. (Nuclear Fuel Services, Inc., Rockville, Md. (USA)). 31 Oct 1974. 8p. Dep. NTIS $4.00.

The status of environmental monitoring, discharge of gaseous effluents and low-level liquid effluents, and surveillance tests is reported. Performance of the Low Level Liquid Waste Treatment Plant is given. (LK)

13819 (DOCKET-50268-49) MIDWEST FUEL RECOVERY PLANT. Order Authorizing the Dismantling of the Facility to Render It Inoperable. (General Electric Co., San Jose, Calif. (USA). Nuclear Fuels Dept.). 21 Nov 1974. 4p. Dep. NTIS $4.00.

13820 (DOCKET-50268-50) MIDWEST FUEL RECOVERY PLANT. Notice of Intent to Issue an Order Authorizing the Dismantling of the Facility to Render It Inoperable. (General Electric Co., San Jose, Calif. (USA). Nuclear Fuels Dept.). 31 Oct 1974. 9p. Dep. NTIS $4.00.

13821 (RT/ING-(73)8(Encl.1)) SAFETY REPORT OF THE ITREC PLANT. Stampone, E. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). 1973. 442p. (In Italian). Dep. NTIS (US Sales Only) $25.25.

Diagrams, charts, graphs, and figures supporting the text in the original report are presented. The original report was previously abstracted for NSA and appears as 29: 18236. (TFD)

13822 LABORATORY AND REMOTE ANALYTIC CONTROL OF REPROCESSING OF ATOMIC POWER PLANT FUEL ELEMENTS. Klygin, A. E.; Kononov, A. N.; Pastukhov, V. G. At. Energ. (USSR); 37: No. 5, 401-407(Nov 1974). (In Russian).

A brief review is presented of the state of laboratory and remote methods of reprocessing control of atomic power plant fuel elements. Methods of control having the best prospects, in the opinion of the authors, are examined and the main unsolved problems noted. (auth)

13823 PROCESS CHEMISTRY OF NEPTUNIUM: OXIDATION OF NEPTUNIUM(IV) BY PLUTONIUM(IV). Patil, S. K.; Ramakrishna, V. V.; Avadhany, G. V. N.; Ramaniah, M. V. (Bhabha Atomic Research Centre, Bombay). pp 275-280 of Proceedings of the Chemistry Symposium. Vol. II. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P2.

Experiments were carried out to study the stability of Np(IV) and Pu(IV) together under the conditions relevant to the feed of the second cycle in the Purex process and to study the stability of Np(V) and Pu(IV) together under the conditions relevant to the feed of the plutonium purification cycle. (LK)

13824 PROCESS CHEMISTRY OF NEPTUNIUM: COUNTER CURRENT EXTRACTION STUDIES FOR THE COEXTRACTION OF NEPTUNIUM IN THE PUREX PROCESS. Patil, S. K.; Nadkarni, M. N.; Kumar, S. V.; Kartha, P. K. S.; Sonawane, R. R. (Bhabha Atomic Research Centre, Bombay). pp 281-290 of Proceedings of the Chemistry Symposium. Vol. II. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P2.

Results from counter-current extraction studies on the co-extraction of neptunium [present in the feed as Np(V)] using nitrous acid and vanadium (IV) to oxidize Np(V) to Np(VI) are presented. (LK)

13825 THERMODYNAMICS OF NITRIDE FORMATION REACTIONS IN MOLTEN TIN-BASED ALLOYS CONTAINING SELECTED FISSION-RELATED ELEMENTS WITH APPLICATIONS TO NUCLEAR FUEL REPROCESSING. Fuwa, A. Stanford, CA; Stanford Univ. (1974). 180p. University Microfilms Order No. 74-27,021.

Thesis (Ph. D.).

The equilibrium thermodynamics of nitride formation reactions in molten Pr-Sn, Gd-Sn, Y-Sn and U-Gd-Sn alloys were experimentally determined using a Sieverts-type apparatus. The experimental results so obtained were applied to evaluate the potential of selective nitriding reactions for separating uranium from nuclear fission products in spent fuel materials. The standard free energy of nitride formation equations on the weight percent activity scale were established for each individual reaction as follows: Pr(pct.) + $\frac{1}{2}$ N_2(g) = PrN(s), $\Delta G^\circ = -32{,}600 + 16.8\ T$ for T = 1447 to 1670°C and Pr(wt %) = 0.68 to 2.50 wt %; Gd(pct.) + $\frac{1}{2}$ N_2(g) = GdN(s), $\Delta G^\circ = -28{,}200 + 19.99\ T$ for T = 1410 to 1530°C and Gd(wt %) = 7.0 to 25.0 wt %; Y(pct.) + $\frac{1}{2}$ N_2(g) = YN(s), $\Delta G^\circ = -25{,}645 + 15.67\ T$ for T = 1420 to 1510°C and Y(wt %) = 1.43 to 10.12 wt %. Expressions for the ΔG°_{mf} and $\log \gamma^\circ$ on the mole fraction activity scale were estimated for these reactions. In the U-Gd-Sn ternary system, the activities and activity coefficients for uranium and gadolinium were obtained at 1530°C, and the activity coefficient for uranium on the weight percent activity scale can be described by: $\log f_u = \log f_u^\circ + \log f_u^{Gd} = -0.030(\%U) + 0.050(\%Gd)$. Two types of separation methods using selective nitride precipitation reactions in U-Pr-Sn and U-Gd-Sn systems were demonstrated in this research. The separation may be carried out either by precipitating a single nitride, e.g., UN, sinking to the bottom of the solution, leaving other elements dissolved in the solution, or by obtaining a sink-float separation with multiple nitrides precipitating, e.g., UN sinking and the other nitrides rising. Separation experiments using uranium and synthetic spent fuel materials (e.g., 9.5% U-0.1% Pr-0.1% Ce-0.05% Zr-0.05% Nb-0.05% Mo-0.05% Ru-Sn) in a liquid tin solution representing about 4 percent burnup were conducted following the procedures proposed by Parlee and Anderson. It has been shown that uranium can be recovered as high purity UN precipitates, essentially free from contamination of fission product elements. The fission product elements were found to remain in the tin solution. The separation concepts and techniques for reprocessing of nuclear spent fuel based on selective nitride formation reactions in tin solutions have been shown to be very sound and promising. (Diss. Abstr. Int., B)

CONTROLLED THERMONUCLEAR RESEARCH

Plasma Confinement and Heating

13826 (AD-782288) RECENT TRENDS IN SOVIET RESEARCH. Hibben, S. G.; Kourilo, J. Translated from Various Russian Journals (30 Jun 1974). 36p. NTIS $5.00.

A brief collection of abstracts on a variety of recently noted R and D topics from the Soviet technical and popular press is presented. Topics include laser heating, radiohолography, laser isotope separation, plasma generation, basalt fiber, and superconductivity. (auth)

13827 (CONF-741105-46) ELECTROSTATIC TRAPPING OF HIGH-Z IMPURITY IONS AND α-PARTICLE TRANSPORT IN TOKAMAK PLASMAS. Hazeltine, R. D.; Ware, A. A.; Sigmar, D. J.; Hirshman, S. P.; McCune, J. E.; Crume, E. C.; Hogan, J. T.; Clarke, J. F. (Texas Univ., Austin (USA); Massachusetts Inst. of Tech., Cambridge (USA); Oak Ridge National Lab., Tenn. (USA)). 1974. Contract AT(11-1)-3070. 23p. (IAEA-CN-33/A15-3). Dep. NTIS $4.25.

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

New neoclassical effects are reported resulting from the nonuniform density of impurity ions on a magnetic surface. Nonuniformity arises partly from toroidal effects directly and partly from the associated electrostatic potentials. There is a new pinch effect involving passing particles and a corresponding bootstrap current. There is no increase in electron diffusion; the diffusion driven by the friction of the new bootstrap current is cancelled by the interaction of the Pfirsch–Schluter current with the variable part of the resistivity. At the high collision frequency end of the plateau regime the pressure gradient needed to balance the combined pinch effects is substantially increased; this will help explain the increase in $-dT_e/dr$ with decreasing radius observed in ST. Thermalized α-particle and fuel ion diffusion were studied in a reactor-like Tokamak plasma. The coupled continuity equations for n_α and n_i, with the fluxes Γ_α and Γ_i given by a previously developed impurity theory in the banana regime, are discussed analytically and solved numerically. If the superthermal α-particles remain near their birthflux surfaces during slow down, n_α is strongly coupled to $n_i^2 \langle\sigma_f v\rangle$ and Γ_α is outward, Γ_i inward. This enables refueling from the edge. If the shape of n_α is decoupled from $n_i^2 \langle\sigma_f v\rangle$, Γ_α is inward and Γ_i outward, until Taylor's impurity equilibrium is reached. Using distributed refueling sources, one can nevertheless achieve steady state profiles with tolerable α-particle concentration. (auth)

13828 (EUR-CEA-FC-705-TR) BEHAVIOR OF THE TOKAMAK T4 DEVICE PLASMA AT HIGH DISCHARGE INTENSITIES. Verskov, V. A.; Lysenko, S. E.; Semenov, I. B.; Serbak, A. F. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). Sep 1973. Translation of IAE-2291. 26p. (In French). INIS.

The results of experiments carried out with the TOKAMAK-4 device at high discharge intensities (90 to 240 kA) are presented. It is shown that plasma fluctuations can lead to particle losses. Relations between energy confinement times and discharge parameters are given. It is emphasized that impurities originating from the diaphragm have a considerable influence on the plasma energy balance as a result of increasing the energy gradient of the discharge. (INIS)

13829 (EUR-CEA-FC-706-TR) ROLE OF IMPURITIES IN EXPERIMENTS WITH EXISTING TOKAMAKS. Verskov, V. A.; Mirnov, S. V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR. Moscow. Inst. Atomnoj Ehnergii). Sep 1973. Translation of IAE-2298. 53p. (In French). INIS.

The effects of multiple charge impurities in Tokamak plasmas are discussed. The first of these effects is the cooling of the plasma at its periphery as a result line spectra radiation. In consequence, a narrowing of the electrical conductivity profile, sigma(r), may occur and thus a corresponding effect on the current density j(r) at high n(e) values. A concurrent concentration of highly ionized impurities towards the plasma axis also occurs with a resulting flattening, or even skin effect. The results of soft x-ray measurements (3 to 10 keV) lead to conclusions about the behavior of impurities at the center of the plasma. It was found that the impurity concentration at the center can be interrupted by the development of plasma instabilities (in particular helicoid and rupture instabilities). The part played by impurities in the formation of the sigma profile becomes increasingly important as T(e), n(e) and the time duration of the discharge continue to increase. At a particular level, the effect of these impurities can be such as to completely break down the thermal insulation and stability of the plasma. (INIS)

13830 (EUR-CEA-FC-715) SPECTROSCOPIC DETERMINATION OF PARTICLE CONFINEMENT TIMES IN TFR TOKAMAKS. Breton, C.; Mattioli, M.; Ya'akobi, B. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Groupe de Recherches sur la Fusion Controlee; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). Dec 1973. 22p. (In French). INIS.

An attempt was made to establish the confinement time tau(p) of a TFR Tokamak in order to determine the diffusion coefficient and to establish the diffusion regime within the device. The investigations were based on the absolute measurement of the intensity of the D_δ line of deuterium. The parts played by the diaphragm and impurities in the functioning of the device were analyzed. The diaphragm was found to be very important in recycling processes. The measurement of neutral particles at the diaphragm together with the characteristic axial growth length established its function in the processes taking place. Impurities do not have any secondary effects. The confinement time was found to be between 10 and 20 ms, the lower limit probably being rather pessimistic. The diffusion coefficient deduced is very much greater than the neoclassical coefficient. The model used for the impurities indicates a constant flux corresponding to a final proportion of 10% oxygen or 2% molybdenum with respect to the prevailing axial electron density. (INIS)

13831 (GA-A-13149) STUDIES OF NONCIRCULAR CROSS-SECTION TOROIDS IN THE DOUBLET II AND IIA DEVICES. Ohkawa, T.; Baker, C. C.; Brooks, N. H. (General Atomic Co., San Diego, Calif. (USA)). 2 Sep 1974. Contract AT(04-3)-167. 26p. (CONF-741105-48). Dep. NTIS $4.50.

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

Studies of confinement of toroidal plasmas with noncircular cross sections were carried out in the Doublet II device. The motivation for these studies is the expectation that noncircular cross-section devices can operate at significantly higher values of beta than circular cross-section devices. A requirement for the realization of this potential is that noncircular cross-section toroids must obtain values of the safety factor and the poloidal beta comparable to those obtained in circular cross-section toroids. The experimental results from Doublet II substantiate this expectation. Electron temperatures up to 1100 eV and ion temperatures up to 525 eV were measured, yielding values of beta in the range of one percent. These results were obtained for plasma currents in the range of 90–210 kA and the toroidal magnetic field was below 10 kG. In order to obtain plasmas with noncircular cross sections, it is necessary to establish special boundary conditions for the poloidal magnetic field. These boundaries can be established by conducting walls (field shapers) or by field coils with properly controlled currents and voltages. Some aspects of plasma control are simplified by the use of field shapers, but little configurational flexibility is possible, and diagnostic access is difficult. Therefore the Doublet II device was modified by replacing the field shaper with field coils. The modified device, called Doublet IIA, has been completed and is in the early stage of operation. (auth)

13832 (SFTI-5) PLASMA HEATING DURING THE DEVELOPMENT OF PARAMETRIC TURBULENCE NEAR THE LOWER HYBRID FREQUENCIES. Demirkhanov, R. A.; Khorasanov, G. L.; Sidorova, I. K. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Sukhumi. Fiziko-Tekhnicheskij Inst.). 1974. 21p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

The possibility of heating a plasma in the turbulent regime, appearing under the effects of strong radiation whose frequency is close to the lower side of the high-frequency plasma oscillation $\omega_{LE}(K_z/K)$ is discussed. Some experimental results on the parametric heating of the alkali plasma in the Q machine are reported. The effect of abnormal absorption of the high-frequency power, detected in these experiments, indicates that the region of lower hybrid frequencies ($\lambda \approx 3$ to 10 cm) can be used for the effective heating of a plasma in a toroidal system. (tr-auth)

13833 ION CYCLOTRON HEATING BY A TRANSVERSELY MODULATED ELECTRON BEAM-PLASMA INTERACTION. Yamamoto, Y.; Yatsui, K. (Osaka Univ., Toyonaka, Japan). J. Phys. Soc. Jap.; 36: No. 5, 1423-1427(May 1974).

The interaction of transversely modulated electron beams with an axially magnetized plasma was studied experimentally from a

viewpoint of ion heating. When the modulation frequency almost coincides with the ion cyclotron frequency, considerable heating of ions was observed up to 40 eV. This type of ion heating was found to be very effective in directions perpendicular to the axial magnetic field. At magnetic beach, the excited waves tend to decay strongly and the associated heating of ions occurs as a result of the cyclotron resonances with atomic- and molecular-ions. The ion heating observed in the present study seems to be due to the cyclotron damping of the ion cyclotron waves excited intensively in the beam–plasma system. (auth)

13834 THEORY OF ANOMALOUS RESISTIVITY AND TURBULENT HEATING IN PLASMAS. Tange, T.; Ichimaru, S. (Tokyo Univ.). J. Phys. Soc. Jap.; 36: No. 5, 1437-1445(May 1974).

General expressions for the dc resistivity and the heating rates of the electrons and the ions were obtained in terms of the spectral functions of particle correlation functions; the results are rigorous and applicable to both quiescent and turbulent plasmas. The method of analysis is based on the moment calculations of the first equations of the Bogolyubov–Born–Green–Kirkwood–Yvon hierarchy for a multicomponent plasma. Definite predictions are made on the relative magnitudes of the electron and ion heating rates when the nature of the turbulent fluctuations is known. Some of the well-known formulas for the anomalous resistivity are obtained as specific cases of the present calculation. It is shown that a consideration of the critical fluctuations alone cannot account for the anomalous resistivity in a turbulent plasma. (auth)

13835 INTERACTION OF INTENSE CO_2 LASER RADIATION WITH A DENSE LASER PRODUCED CARBON PLASMA. Rumsby, P. T.; Michaelis, M. M. (UKAEA Research Group, Abingdon, Culham Lab.). Phys. Lett., A; 49: No. 6, 413-414(21 Oct 1974).

A high density laser-produced carbon plasma is heated with the beam from a pulsed CO_2 laser. The evolution of the electron density profiles is studied by interferometry. (auth)

13836 TOROIDAL PLASMA RESONANCES AND ELECTRON TRANSIT TIME DAMPING FOR HEATING LARGE THERMONUCLEAR TORI. Messiaen, A. M.; Vandenplas, P. E. (Ecole Royale Militaire, Brussels (Belgium). Lab. de Physique des Plasmas). Phys. Lett., A; 49: No. 6, 475-477(21 Oct 1974).

A new method is advocated consisting of combining the large amplification of the rf field strength inside the plasma due to a magnetosonic resonance or to a torsional wave resonance of the toroidal cavity with its collisionless damping resulting from electron transit time damping. (auth)

13837 DETERMINATION OF THE CRITICAL VALUE OF THE ADIABATICITY PARAMETER FOR ELECTRONS MOVING NEAR THE MIDPLANE OF A MAGNETIC BOTTLE. Il'ina, A. N.; Ill'in, V. D. (Moscow State Univ.). JETP Lett. (USSR) (Engl. Transl.); 19: No. 12, 388-389(20 Jun 1974).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 19: No. 12, 755-757(20 Jun 1974).

The numerical critical value of the adiabaticity parameter is obtained for electrons injected in the midplane of a magnetic bottle with the aid of crossed fields E and H and pitch angles $\alpha \sim 90°$. (auth)

Plasma Diagnostics

Refer also to abstract 13880.

13838 (AD-774453) ELECTRON PLASMA DENSITY DETERMINATIONS WITH A 50 GHz FABRY–PEROT INTERFEROMETER. Andrews, M. L.; Martin, J. S. (Wright State Univ., Dayton, Ohio (USA). Dept. of Physics). Nov 1973. Contract F33615-69-C-1842. 40p. (ARL-73-013). NTIS $3.25.

A microwave Fabry-Perot interferometer operating in the 50 GHz region was analyzed and employed in the measurement of electron densities within a plasma. Both volume perturbation and ray refraction approaches were applied to determine the practical limits of the system. In the symmetric spherical mirror geometry a mirror separation approaching the concentric configuration proved least susceptible to plasma refraction limitations. After limiting the resonances to the lowest order modes with apertures the general resonance shift was found to agree with calculations when known dielectric perturbations were used. To follow resonance shifts within the plasma chamber where mirror separation could not be varied a swept impatt diode generator was employed. (GRA)

13839 (AD-776800) REAL TIME LANGMUIR PROBE DATA REDUCTION BY A MINICOMPUTER FOR A COLLISIONLESS PLASMA. Interim Technical Report, March 1972–March 1973. Corbin, J. C. Jr.; Curtis, J. A.; Growjean, D. F.; Andrews, M. L.; Martin, J. S. (Wright State Univ., Dayton, Ohio (USA)). Dec 1973. 128p. (ARL-73-0114). NTIS $4.75.

A real time Langmuir probe data reduction program was developed and applied to a mirror geometry electrodynamic magnetoplasma experiment (ELMAX). The total program requires less than one minute to determine the electron temperature, ion density, and plasma and floating potentials at one position in the plasma. (auth)

13840 (EUR-CEA-FC–732) ANALYSIS OF LIGHT SCATTERING DATA FROM RELATIVISTIC PLASMAS. Mattioli, M.; Papoular, R. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Groupe de Recherches sur la Fusion Controlee; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). Apr 1974. 20p. Dep. NTIS (US Sales Only) $4.00.

The relativistic theory developed by previous authors for the spectral profile of a Thomson-scattered wave is applied to the highest temperatures expected from currently planned fusion machines (25 keV). Adequate procedures for data reduction and error analysis are described and applied to experimental results collected on TFR. These computations yield relativity-corrected temperatures and error bars which differ already considerably from those obtained by the usual procedures. The temperatures are as much as 35% lower, and the errors 50% less, than the corresponding classical values. (FR)

13841 (TID-26696) SPECTROSCOPIC STUDY IN THE VACUUM ULTRAVIOLET OF A NEON PLASMA IN ELMO. Cobble, J. A. (Tennessee Univ., Knoxville (USA)). Aug 1974. 112p. Dep. NTIS $8.75.

Thesis.

ORNL's ELMO device contains an electron-cyclotron-heated plasma in a simple mirror trap. The relative intensities of line radiation in the vacuum ultraviolet for five charge states of neon in ELMO were measured with a calibrated, grazing incidence spectrometer. Theoretical models for the excitation and ionization of atomic systems in the plasma are based on an optically thin, corona approximation in which atom-electron collisions play the main part. The resulting population-balance equations for excited states in the excitation model are employed to measure the temperature of cold electrons which form the background plasma. Once this parameter is known, the density ratios of the various charge states present may be determined. Absolute densities of ions and electrons following from pressure measurements are next presented. Comparison of experimental results with the theoretical ionization model permits the estimation of a particle containment time and an ion temperature. Calculated plasma parameters are consistent with previous measurements of these variables when such measurements exist, and there is qualitative agreement with the estimates when no other assessment is available. (auth)

13842 MEASURING APPARATUS FOR SUPERHIGH TEMPERATURE PLASMA. Fujita, J. (Nagoya Univ., Japan). Oyo Butsuri; 43: No. 3, 276-279(Mar 1974). (In Japanese).

Two methods of measurement for superhigh temperature plasma are introduced and discussed. The measurement of energy spectra of fast neutral particles gives information on the energy distributions of ions just before charge transfer in plasma. Existence of known neutral molecules in plasma and information on the cross section of charge transfer between the neutral molecules and plasma ions are necessary conditions. A schematic diagram of a neutral particle analyzer is shown. The apparatus for the measurement of neutral particles consists of a guide, a stripping cell, an ion energy analyzer, a counter-recorder and a vacuum system. Compact energy analyzers such as channeltron have been recently developed. These analyzers are suitable for the scaling method, and energy distribution can be obtained. For the measurement of high density plasma, however, the detection of electric current should be considered. The point of charge transfer occurrence by this method is difficult to determine. Interference with the apparatus for plasma generation is another problem. A method of measurement of electron temperature by Thomson scattering by laser beams was introduced. Problems associated with this method are discussed. (JA)

Plasma Kinetics (General)

13843 (AD-781668) PROBLEMS OF HIGH-CURRENT RELATIVISTIC ELECTRON BEAMS. Bogdankevich, L. S.; Rukhadze, A. A. Translated by V. Mesenzeff from Priroda; No. 2, 46-49(Feb 1973). 17p. (FTD-HT-23-1335-74). NTIS $3.00.

13844 (AD-782081) INJECTION OF INTENSIVE FLOWS OF HIGH-SPEED HYDROGEN IONS AND ATOMS. Semashko, N. N. 25 Jun 1974. Translated by R. E. Courville from pp 301-309 of Plazmennye Uskoriteli, 1973. (FTD-HT-23-1098-74). 18p. NTIS $3.00.

Ion injectors, including ion sources, focusing, and neutralization are discussed. Hydrogen ion beams are discussed as examples. (GRA)

13845 (FRNC-TH-510) STUDY OF A HIGH FREQUENCY DISCHARGE IN HYDROGEN IN A TRANSVERSE MAGNETIC FIELD. Grolleau, B. (Nantes Univ., 44 (France)). 1973. 180p. (In French). Dep. NTIS (US Sales Only) $12.00.

Thesis.

Inductance-coupled hf discharges in hydrogen under 5×10^{-3} to 10^{-1} torr pressures, 20 to 50 MHz frequency drive were studied, for an up to 300 W hf power and a 34 mm diameter discharge casing. A homogeneous (0 to 70 Gauss) low-current magnetic/static field was superimposed over the hf discharge. Resonance appears when electron gyromagnetic frequency nears double the discharge frequency drive and exists only within a pressure interval whose lower limit (10 m torr) seems fixed in function of drive power and frequency. The upper level, however, appears linked to the discharge power drive. This limit is all the higher that hf power is great. With the highest experimentally-available hf power, the recorded upper limit hovers about 70 m torr. The importance of static/magnetic field direction in relation to the electrical energizing field direction is shown. Its transverse components only intervene for resonance field calculation; if such components do not exist, there is no resonance. The hf generator-to-plasma coupling method is determinant as induction field existence is linked to such coupling method; it should be noted that the latter field appears indispensable in order to observe resonance. Furthermore, resonance curve width appears linked to the longitudinal electric field and for sufficiently high hf resonance, peaks split into two peaks that are symmetrically balanced in relation to the initial peaks. Electronic densities (in the order of $5 \times 10^{11} cm^{-3}$) are easily obtained with this resonance. By acting upon the magnetic/static field, the electronic density can be modified at will. Therefore, the resonance appears as a particularly-well adapted means to increase and control a hf discharge plasma density. (FR)

13846 (INIS-mf-1501) PHYSICS DISCIPLINE. Annual Progress Report, December 1973. (Flinders Univ. of South Australia, Bedford Park. School of Physical Sciences). Dec 1973. 65p. INIS.

Research being conducted in plasma physics includes such topics as: wave propagation, high beta plasmas, shock waves and magnetohydrodynamics. In atomic physics, work is proceeding in electron reactions, electron scattering from inert gases and atomic hydrogen, crossed field breakdown at low gas pressures and transport parameters of electrons in hydrogen. In nuclear physics, studies are centered on the three nucleon problem. Other topics include: the binding energy of tritium, (p,2p) reactions and (α,2α) reactions. Research in statistical mechanics and solar energy is also reported. (INIS)

13847 INVESTIGATION OF THE DYNAMICS OF FORMATION OF ELECTRON BEAMS IN A LINEAR DISCHARGE. Lutsenko, E. I.; Sereda, N. D.; Kontsevoi, L. M. (Kharkov State Univ.). Zh. Eksp. Teor. Fiz.; 67: No. 3, 979-989(Sep 1974). (In Russian).

It is shown that generation of strong electron beams in linear discharges occurs at a plasma concentration $n \sim 10^{12}$ to 10^{13} cm^{-3} in space charge layers which may arise near the electrodes, as well as in the plasma column. During the discharge they move with a velocity $v \sim 10^6$ to 10^7 cm/sec from the cathode to anode. The formation and movement of the layers are related to restriction of the current carriers at the cathode or in the plasma due to inhomogeneity of the latter. The magnitude of the beam produced in the space charge layer is determined by the emission properties of the cathode and plasma whereas its duration is determined by instabilities arising in the discharge. (auth)

13848 TURBULENT SHOCK WAVE IN A LOW-DENSITY UNMAGNETIZED PLASMA. Volkov, O. L.; Eselevich, V. G.; Kichigin, G. N.; Papernii, V. L. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Zh. Eksp. Teor. Fiz.; 67: No. 5, 1689-1692(Nov 1974). (In Russian).

A turbulent shock wave was observed in the flow of an ultrasonic low-density plasma onto a magnetic barrier. Formation of the front is ascribed to development of ion beam instability induced by part of the flow reflected from the magnetic barrier. (auth)

13849 STEADY-STATE CURRENTS OF A PLASMA IN A MAGNETIC FIELD. Morozov, A. I.; Solov'ev, L. S. Vop. Teor. Plazmy; No. 8, 3-87(1974). (In Russian).

A discussion is presented of magnetohydrodynamic plasma currents and steady-state plasma accelerators. Topics covered include the mechanisms of acceleration, the microscopic picture, conditions for an electric field in the plasma, perturbations of the plasma flow, basic equations and the exchange parameter ksi; axisymmetric currents in an ideal plasma in a magnetic field with ksi equal to zero, conservation laws and equations, currents in a narrow flow tube, integratable cases, current eddies and critical surfaces; currents in axisymmetric channels under a longitudinal magnetic field, integral characteristics, channels with slowly changing cross section; axisymmetric currents and the Hall effect, currents of a two-component plasma in a narrow pipe with the parallel field zero, the currents in a smooth channel, and others. (IAA)

Plasma Kinetics (Experimental)

13850 EXPERIMENTAL INVESTIGATION OF STRONG TURBULENCE IN A SHEARED MAGNETOPLASMA COLUMN. Robinson, J. E.; Lidsky, L. M. (Massachusetts Inst. of Tech., Cambridge). Can. J. Phys.; 52: No. 18, 1739-1749(15 Sep 1974).

An experimental investigation of low frequency ($\omega < \Omega_i$) strong turbulence in a transversely sheared magnetoplasma column is reported. A single large amplitude mode and a broad band spectrum are observed in the radial region of sheared azimuthal velocity. The large amplitude mode, previously identified as Kelvin–Helmholtz turbulence, is studied with respect to coherence, amplitude saturation, and temporal evolution. General agreement is found with Dupree's strong turbulence theory. However, both coherent and incoherent trapping appear to be important for amplitude saturation and coherence. Spatial spreading of the mode is also observed during temporal evolution indicating a more complex wave particle interaction than is currently assumed in nonlinear theory. Using correlation techniques, the broad band spectrum is found to consist of azimuthally propagating clumps of "ballistic modes" which produce an $\tilde{n}(\omega) \propto \omega^{-2}$ spectrum. The clumps have a scale size of the order of a Larmor radius, propagate with the average rotation velocity, appear to be amplitude limited by trapping, and diffuse spatially as they decay. This observation of clumps represents the first experimental identification of "ballistic modes" in a magnetoplasma column. (auth)

13851 EXPERIMENTAL INVESTIGATION OF ANODE PROCESSES IN A CLOSED ELECTRON-DRIFT ACCELERATOR. Melikov, I. V. Sov. Phys.-Tech. Phys. (Engl. Transl.); 19: No. 1, 35-37(Jul 1974).

Translated from Zh. Tekh. Fiz.; 44: No. 1, 59-64(Jan 1974).

The discharge regions adjacent to the anode surface in a closed electron-drift plasma accelerator (ACED) are studied. Electrons from the accelerator channel pass through the anode apertures entering into the internal cavity; these electrons cause primary ionization of the working gas (xenon) fed through the anode. Probe methods are used to determine the plasma parameters near the apertures in the anode (T_e = 5 to 13 eV and $N_e \simeq 10^{10}$ to 10^{11} cm^{-3}) and the dependence of the parameters on the accelerator voltage and gas flowrate. The neutral gas pressure in the anode cavity is measured (~1 mm Hg) as a function of gas flowrate and mode of operation. (auth)

13852 REDUCTION OF ELECTRON DENSITY IN A PLASMA BY INJECTION OF LIQUIDS. Sodha, M. S.; Evans, J. S. (National Aeronautics and Space Administration, Langley Station, Va. (USA). Langley Research Center). Appl. Sci. Res. (The Hague); 29: No. 5, 380-398(Sep 1974).

The physics of various processes relevant to the reduction of electron density in a plasma by addition of water droplets were investigated; two processes have in particular been analyzed in some detail, viz, the electron attachment to charged dielectric droplets and the emission of negative ions by vaporization from these droplets. The results of these analyses have been applied to a study of the kinetics of reduction of electron density and charging of droplets in an initially overionized plasma, after addition of water droplets. A number of simplifying assumptions including uniform size and charge on droplets and negligible change in the radius of the droplet due to evaporation have been made. Heat transfer between the droplets and the plasma has been neglected. It has also been assumed that the Debye radius is much greater than the radius of the droplets, which limits the treatment to droplets having radii, less than one micron (for electron densities of the order of $10^{18} m^{-3}$.). The reduction of electron density by the suspension of water droplets in an equilibrium plasma was also studied. The investigation is purely theoretical in nature; considerable experimental work is necessary to validate the theoretical considerations. (auth)

13853 TRANSMISSION OF A HIGH-CURRENT RELATIVISTIC BEAM THROUGH A GAS. Tkach, Yu. V.; Magda, I. I.; Skachek, G. V.; Pushkarev, S. S.; Panchenko, I. P. (Physicotechnical Inst., Kharkov). Sov. Phys.-Tech. Phys. (Engl. Transl.); 19: No. 3, 412-413(Sep 1974).

Translated from Zh. Tekh. Fiz.; 44: No. 3, 658-660(Mar 1974).

The formation of the return current is studied experimentally in an electron accelerator at energies up to 1 MeV and at currents up to 50 kA. The results agree with a model which only takes account of elementary processes. The velocity of the ionization front is measured in various gases at pressures of 5×10^{-2} to 10 torr. (auth)

Plasma Kinetics (Theoretical)

Refer also to abstract 13852.

13854 (AD-779890) STUDY OF EQUATIONS OF STATE/OPACITY OF IONIZED GASES. Final Report, 31 October 1972-31 October 1973. Harvey, J. M.; Katz, I.; Vik, R. C. (Systems, Science and Software, La Jolla, Calif. (USA)). Oct 1973. Contract DNA001-73-C-0061. 84p. (SSS-R-73-1946). NTIS $4.00.

The report describes additions and modifications to the CAPO system of opacity codes and presents the results of other research tasks on emission, absorption, and transport of radiation in high temperature materials. The accuracy of several approximate methods of opacity treatment is assessed. The radiative properties of thin plasmas, not in local thermodynamic equilibrium (non-lte) are considered. Several codes written to provide ionic charge distributions, excited state populations, and emission rates in non-lte plasmas are described. Electron-positron pair production rates are studied and estimates made of the times required to establish significant pair populations under various conditions. (auth)

13855 (AD-781177) INFLUENCES OF COULOMB COLLISIONS ON THE SPECTRA OF COLLECTIVE SCATTERED RADIATION FROM FULLY IONIZED PLASMAS. Niimura, M.; Chan, P. W. (Colorado State Univ., Fort Collins (USA). Dept. of Electrical Engineering). Sep 1973. Contract F19628-70-C-0035. 103p. (AFCRL-TR-73-0615). NTIS $4.50.

Complete profiles of the Coulomb-collision corrected scattered spectrum of the ion central lines from near ion-acoustic resonances to zero frequency shift and those of the electron-plasma lines were computed for a fully and singly ionized plasma with equal electron and ion temperatures in the absence of an external magnetic field. The numerical calculations presented here are primarily based on the theoretical works of Dubois et al., the results are compared with those predicted by the cpllisionless plasma theory. (auth)

13856 (AD-782555) OBSERVATIONS ON THE EFFECT OF STEPWISE IONIZATION ON THE DISTRIBUTION FUNCTION AND TRANSPORT AND BALANCING MAXIMA OF ELECTRONS IN A NEON LOW-PRESSURE PLASMA AT A LOW DEGREE OF IONIZATION. Wilhelm, J.; Winkler, R.; Freitag, H. Translated from Beitr. Plasmaphys.; 10: No. 2, 171-181(1970). 22p. (FTD-HC-23-1447-74). NTIS $3.00.

13857 (AD-784394) NUMERICAL CALCULATION OF NONUNIQUE SOLUTIONS OF A 2D SINH-POISSON EQUATION. McDonald, B. E. (Naval Research Lab., Washington, D. C. (USA)). Jul 1974. 22p. (NRL-MR-2828). NTIS $3.00.

A method is described for computing non-trivial solutions to the nonlinear partial differential equation (del squared) psi + (lambda squared) sinh psi = O, with psi = O on a square boundary. The method consists of a Newton-Raphson iteration, in which successive corrections to psi must satisfy a linearized partial differential equation. A direct solution algorithm is given for the linearized equation, which is suitable for small meshes. Using this method, the nonuniqueness of solutions is shown by finding six solutions for the same value of lambda. Calculation of these solutions required from 4 to about 40 iterations each, depending upon the accuracy of the initial approximation. (auth)

13858 (COO-2059-41) THERMAL RELAXATION OF A PLASMA IN A UNIFORM MAGNETIC FIELD. Hsu, J. Y.; Joyce, G.; Montgomery, D.; Turner, L.; Vahala, G. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy). Aug 1974. Contract AT(11-1)-2059. 15p. (CONF-741024-2). Dep. NTIS $4.00.

From second international conference on plasma theory; Kiev, USSR (28 Oct 1974).

A formulation of the theory of the thermal relaxation of uniform plasmas was given which includes the effect of a uniform dc magnetic field at the microscopic level, both in two and three dimensions. To increase the magnetic field is to increase the relaxation time, linearly in two dimensions and logarithmically in three. The gyroradius of the lighter species of particle behaves as a cutoff for the Coulomb potential in the collision integral for two species when the Debye length is greater than the smaller gyroradius. A satisfactory kinetic theory, without divergences, can be given for many phenomena without reference to Debye screening or the dielectric nature of the plasma. (auth)

13859 (INR-1440/21/PM) NUMERICAL SOLUTION OF THE NONLINEAR VLASOV EQUATION. Makosa, D. (Institute of Nuclear Research, Warsaw (Poland)). 1972. 26p. INIS.

A description of the algorithm for the numerical solution of the nonlinear Vlasov equation is presented. An initial-boundary value problem related to the theory of a plasma oscillation was solved, using the "SPS" program applying this method. For the same problem, the calculation was performed using the algorithm developed by Gelfand. The more accurate results were obtained by the "SPS" program. (auth)

13860 (IPP-3/13) JOINT STATISTICAL COUNT OF FREE AND BOUND ELECTRON STATES. Klueber, O.; Wulff, H. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F.R. Germany)). Jun 1974. 19p. (In German). INIS.

A uniform count of all electron states, i.e., bound and free, is presented. The search for the entropy maximum then yields the equilibrium distribution. The latter is described by formulas from which one can derive the Boltzmann coefficient, Maxwell-Boltzmann velocity distribution function of free electrons, and the Saha equation. (auth)

13861 (NP-20262) USE OF MULTI-PARAMETRIC REGRESSION ANALYSIS IN PLASMA PHYSICS. Voronov, G. S. (AN SSSR, Moscow. Fizicheskij Inst.). 1973. 31p. (In Russian). Dep. NTIS (US Sales Only) $4.75.

The characteristics of the use of the method of regression analysis in plasma experiments are examined. For cases of linear multi-parametric regression the effect of the errors in the measurement of the original values of the parameters and their correlation is taken into consideration. (auth)

13862 INJECTION OF RELATIVISTIC ELECTRON BEAM INTO A PLASMA WITH A STRONG SPATIAL DISPERSION. Rostomyan, E. V.; Rukhadze, A. A.; Semikoz, V. B. (Lebedev Inst. of Physics, Moscow). Zh. Eksp. Teor. Fiz.; 67: No. 3, 990-993(Sep 1974). (In Russian).

The problem of injection of a monoenergetic electron beam into a plasma was solved by taking into account spatial dispersion. It is shown that when mean free path of the plasma electrons is much smaller than the beam radius and spatial dispersion is small, the diffusion relaxation length of fields and currents induced in the plasma by the beam is determined by the collision dispersion. (auth)

13863 TURBULENT DISPERSION OF A FAST PARTICLE CLOUD IN A PLASMA. Bespalov, P. A.; Trakhtengerts, V. Yu. (Scientific-Research Inst. of Radiophysics, Moscow). Zh. Eksp. Teor. Fiz.; 67: No. 3, 969-978(Sep 1974). (In Russian).

Nonstationary expansion of a cloud of fast electrons in a cold plasma with a weak magnetic field is considered. It is shown that for a broad range of parameters dispersion of the particles occurs in a diffuse manner with a characteristic velocity which is much less than the particle velocity. Effective isotropization of the particle velocity directions occurs during dispersal of particles, deformation of the energy spectrum being comparatively weak as a whole. A feature of turbulent dispersal is "evaporation" of sharply anisotropic particle beams from the cloud, their velocities being directed along the direction of dispersal. The velocity of the particles is close to that for free dispersal. (auth)

13864 CGL INVARIANTS AND THE MOMENTS OF THE BOLTZMANN-VLASOV EQUATION. Fridman, M. (Univ., Liege). Can. J. Phys.; 52: No. 14, 1345-1357(15 Jul 1974).

The transport laws of the noncollisional systems must be obtained from the Boltzmann-Vlasov equation. The most simple cases are the CGL invariants along the magnetic field. The essential problem is to determine the criteria necessary to close the moments system. The lower order in the gyration radius expansion gives the perpendicular contribution to the heat flux. After expansion with the supersonic conditions, the parallel contribution is obtained, and also the second term of the expansions in which the first term is the "invariant." The numerical value of the heat flux can be considered in good agreement with the solar wind parameters, and the corrections to the invariants are found to agree with previous results (kinetical and 20-moments Grad approximation). (auth)

13865 EFFECT OF POLARIZATION OF A PLASMA ON ITS KINETIC PROPERTIES IN THE PRESENCE OF A STRONG ELECTRIC FIELD. Klimontovich, Yu. L.; Puchkov, V. A. (Moscow State Univ.). Zh. Eksp. Teor. Fiz.; 67: No. 2, 556-566(Aug 1974). (In Russian).

Fluctuations in a plasma in the presence of a strong electric field are calculated by taking into account polarization. Allowance for polarization in a high frequency field is connected with nonstationarity of the fluctuation process. An expression for the collision integral in a strong field is found by taking into account polarization. The conductivity of the plasma is calculated on basis of the kinetic equation derived. It is shown that at field frequencies close to the Langmuir frequency the conductivity becomes field-dependent at comparatively low intensities. (auth)

13866 THEORY OF SPECTRAL LINE BROADENING IN A NONEQUILIBRIUM, PARTIALLY IONIZED PLASMA. Asmaryan, E. A.; Klimontovich, Yu. L. Vestn. Mosk. Univ., Ser. III. Fiz. Astron.; 15: No. 3, 273-281(1974). (In Russian).

Consideration is given to broadening of atomic spectral lines caused by electrons and neutral atoms in a nonequilibrium, partially ionized plasma in a shock approximation. Expressions are presented for the line broadening γ_{nm} caused by fluctuations of the transverse electromagnetic and longitudinal fields, and also by collective excitations in the plasma. The electron shock width is calculated with all possible transitions from the n, m levels being taken into account in two cases of a nonequilibrium distribution of electron velocities. Calculations were also made on the line width of radiation caused by resonance dipole-dipole interaction of atoms. This expression is compared with the results of other authors. (SJR)

13867 STABILITY AND THE EXTENDED ENERGY PRINCIPLE OF PLASMA PHYSICS. Seymour, P. W.; James, M. K. (Univ. of Adelaide). Aust. J. Phys.; 27: No. 3, 307-318(Jun 1974).

The consequences of stress continuity across the plasma-vacuum interface on plasma stability are considered for a system having zero internal magnetic field, and it is shown that neutral stability is obtained at best. For the extended energy principle of plasma physics the viewpoints of Bernstein et al. (1958), Rose and Clark (1961) and Schmidt (1966) are reconciled by means of a rigorous and informative treatment alternative to that of Bernstein et al. The present work is a closely related sequel to the treatment of the hydromagnetic energy principle given by Seymour and James (1973). Derivations close with a discussion of results, finally specialized for a plasma system having zero internal magnetic field, in direct relation to the stability treatment by James and Seymour (1971) of a field-free constricted plasma between electrodes. (auth)

13868 ENERGY GAIN OF A RELATIVISTIC TEST PARTICLE IN A PLASMA-PHOTON SYSTEM. McNeill, W. H. Boston; Northeastern Univ. (1974). 227p. University Microfilms Order No. 74-27,170.

Thesis (Ph. D.).

Test particle energy loss calculations are extended to include statistical and polarization losses for a relativistic test particle in a relativistic plasma, and to include plasmas in a radiation field. A dielectric description of the plasma power loss is obtained. The radiation field is modeled as a random distribution of photons, having a classical distribution function. There is no direct polarization of the photon field, but statistical fluctuations give rise to test particle scattering and energy loss. Since test particle-plasma losses occur to second order in the smallness parameter, while test particle-photon losses to fourth order, the two problems can be considered separately and the power losses simply added. (Diss. Abstr. Int., B)

13869 STABILIZATION OF SOLUTION OF THE HARTREE-FOCK EQUATIONS. Cowan, R. D.; Mann, J. B. (Los Alamos Scientific Lab., NM). J. Comput. Phys.; 16: No. 2, 160-166(Oct 1974).

A very simple method is described for eliminating certain instabilities and other difficulties in the solution of the Hartree-Fock (HF) equations. The method consists of subtracting, from both the homogeneous and inhomogeneous portions of the differential equation, terms which exactly compensate each other in the self-consistent limit. These terms are chosen so as to largely cancel the original inhomogeneous term and thereby make the equation a nearly homogeneous one. (auth)

13870 NUMERICAL CHERENKOV INSTABILITIES IN ELECTROMAGNETIC PARTICLE CODES. Godfrey, B. B. (Los Alamos Scientific Lab., NM). J. Comput. Phys.; 15: No. 4, 504-521(Aug 1974).

Linear dispersion relations for one-dimensional electromagnetic particle simulation codes are analyzed in order to determine numerical stability properties. It is found that fast particles may resonate with light waves of matching phase velocity to produce a severe numerical instability. A Courant condition for this instability is derived and comparison of its restrictiveness made among the various differencing schemes. At least two algorithms permitting reasonably large time steps for relativistic simulations are available. (auth)

13871 IONIZATION CURVES FOR HYDROGEN. Pokrant, M. A. Gainesville, FL; Univ. of Florida (1970). 152p. University Microfilms Order No. 74-27,370.

Thesis (Ph. D.).

A method is presented for calculating, from first principles, the ionization curves and other properties of a multi-component quantum mechanical plasma over a wide range of temperatures and densities. In particular, hydrogen is treated as a system of protons and electrons. The Slater sum is approximated as a product of pair functions. Each of these pair functions depends only on the spatial separation of the two particles and is in the form of a classical Boltzmann factor with the classical potential replaced by an effective potential. The effective potential contains quantum effects which are separable into diffraction effects, symmetry effects, and coupling between the two. The coupling is treated approximately. The classical divergence at zero particle separation is removed by the quantum diffraction effects. This method is exact at infinite temperature; it also appears to be quite good when the temperature is low enough for hydrogen atoms to form. The radial distribution functions may then be found by utilizing the powerful methods which have been developed for classical multi-component fluids. It is possible to determine the fraction of particles which are in the ground state of an atom. A fit to this quantity is obtained as an analytic function of the temperature and density. (Diss. Abstr. Int., B)

13872 SIMPLIFIED COEFFICIENTS IN THE PEKAREK-LEE THEORY OF MOVING STRIATIONS. Shimada, M. (Osaka Kyoiku Univ. (Japan)). Phys. Lett., A; 49: No. 6, 455-456(21 Oct 1974).

Moving striations are the low frequency waves which are universally observed in the weakly ionized plasma, and many investigations about them have been made experimentally and theoretically. The theory originally presented by Pekarek and furthermore developed by Lee et al. is, in spite of its approximate treatment, one of the most excellent theories that describes the phenomena of moving striations under various discharge conditions. The theory comprises not only the backward positive striations usually observed in the rare gas discharge of low pressure, but also the forward positive waves found in the constricted channel of medium pressure. It is the object of the present letter to show that the coefficients a,b,c_1 and c_2 in their theory can be written in more simplified forms with discharge parameters by investigating the equation of energy balance for electrons given by Granowski. (auth)

13873 ELECTROMAGNETIC PROBLEMS OF THE NONEQUILIBRIUM PLASMA. Sitenko, O. G.; Yakimenko, Yi. P. (AN Ukrainskoj SSR, Kiev. inst. Teoreticheskoj Fiziki); Yishimaru, S. (Tokyo Univ. (Japan)); Vil'gel'msson, Kh. Visn. Akad. Nauk Ukr. RSR; No. 4, 8-14(Apr 1973). (In Ukrainian).

Nonlinear electrodynamic properties of a nonequilibrium plasma are considered. It is shown that the nonlinear susceptibilities of a plasma are expressed by correlation functions of higher orders for fluctuations in charge density with interaction between particles being neglected. Collective fluctuations in a nonequilibrium plasma are investigated with nonlinear wave interaction being taken into account. A determination was made of the spectrum of epithermal Langmuir fluctuations in a plasma pierced by a beam of charged particles. A study was made of the effect of nonlinear parameters on plasma stability conditions. It is shown that the shift in frequencies caused by a nonlinear interaction of third order waves leads to saturation of disruptive instabilities in the plasma. (tr-SJR)

13874 NONLINEAR CYCLOTRON RESONANCE IN A PLASMA. Kitsenko, A. B.; Pankratov, I. M.; Stepanov, K. N. (Physical-Technical Inst., Kazan). Zh. Eksp. Teor. Fiz.; 67: No. 5, 1728-1737(Nov 1974). (In Russian).

It is demonstrated that interaction between charged particles and the field of a plane travelling monochromatic wave of small but finite amplitude under resonance conditions for half-integer cyclotron frequency harmonics $\omega(k) = k_z v_z = \frac{1}{2} n\omega_B$ $(n = \pm 1, \pm 3, \ldots)$ results in the appearance of wave damping. (auth)

13875 ANOMALOUS SKIN EFFECT IN A PLASMA WITH A DIFFUSED BOUNDARY IN A MAGNETIC FIELD. Vasil'ev, A. N.; Meierovich, B. E. (Moscow State Univ.). Zh. Eksp. Teor. Fiz.; 67: No. 5, 1738-1749(Nov 1974). (In Russian).

A theory is developed for the anomalous skin effect in a plasma

with a diffused boundary and located in a magnetic field parallel to the electron concentration gradient. Expressions for the plasma surface resistance and for the reflection coefficient of the plasma for electromagnetic waves are obtained for the case when the electron concentration depends on the coordinates exponentially for an arbitrary relation between the electron mean free path, penetration depth of the field in the plasma and size of the transition region at the boundary. The dependence of the surface resistance on degree of anomalousness of the skin effect and on the magnetic field intensity is investigated, as well as of the diamagnetic resonance line-shape in the plasma. (auth)

13876 CERTAIN RELATIVISTIC EFFECTS DUE TO STRONG ELECTROMAGNETIC FIELDS IN PLASMA. Tsintsadze, N. L. (AN Gruzinskoj SSR, Tbilisi. Inst. Fiziki). Phys. Lett., A; 50: No. 1, 33-34(4 Nov 1974).

It is shown that the propagation of a strong electromagnetic wave in an electron plasma can lead to a generation of a constant electron current along the direction of propagation and to a large increase in the average electron density. (auth)

13877 SIMILARITY THEORY OF TURBULENCE IN A PLASMA INHOMOGENEITY. Tchen, C. M. (City Coll., New York). Arch. Mech. Stosow.; 26: No. 3, 451-457(1974).

From symposium on advanced problems and methods in fluid mechanics; Kamienny Potok, Poland (Sep 1973).

The inhomogeneous density and electric field in a plasma cause an instability which develops into turbulence. The turbulent spectrum is divided into three subranges. The mean density gradient of the plasma supplies an energy to the turbulent motions and constitutes a source in the production subrange; the nonlinear behavior maintains a cascade transfer of energy across the spectrum in the inertia subrange; and, finally, the molecular diffusion forms a sink of energy in the dissipation subrange of large wave numbers. A similarity theory is developed, based upon a mixing-length for plasmas and dimensional considerations. It predicts the k^{-3}, k^{-1}, and k^{-5} spectral laws in the respective production, inertia and dissipation subranges of the density spectrum, and a k^{-3} spectral law in all subranges of the electric field spectrum. (auth)

13878 INTERACTIONS OF MOVING PLASMA WITH NON-UNIFORM MAGNETIC FIELDS. Voytsenya, V. S.; Onishchenko, I. N.; Sappa, N. N.; Safronov, V. G.; Trubchaninov, S. A. Fiz. Plazmy Probl. Upr. Termoyad. Sin.; No. 4, 105-113(1973). (In Russian).

Various types of instabilities have been detected in plasmas moving in a uniform magnetic field, and the unstable movements are apparently determined by the properties of the plasma and the conditions of its entry into an axial magnetic field, independently of the source. Systems in which the magnetic field increases with increasing radius and systems with force-line intersections (helical symmetry) restrict some of these instabilities. Experiments conducted with two configurations, a direct stellarator and a quadrupole magnetic field in combination with an axially symmetric field, showed that plasma at a density of approximately $10^{13}cm^{-3}$ moves along force-lines, leading to a better result for the stellarator field than for the combination of an axially symmetric field and a multipole field. The stellarator field was found to reduce the nonuniformity of electric potential observed with the other field and to leave significantly less plasma close to the walls of the container. (JPRS)

13879 NEOCLASSICAL THEORY OF DIFFUSION. Galeev, A. A.; Sagdeev, R. Z. Vop. Teor. Plazmy; No. 7, 205-273(1973). (In Russian).

Transport processes in toroidal systems are discussed. Topics include the kinetic theory of equilibrium in axisymmetric systems, transport coefficients in a rarefied plasma, motion of individual particles, simple model for a torus, electron-electron collisions, neoclassical thermal conductivity of ions, thermoelectric and thermal diffusion effects, transport in less rarefied plasma, equilibrium in a Tokamak device, toroidal stellarators, drift trajectories of "locked" particles near the stellarator axis, numerical calculation of the motion of single particles, super-banana diffusion in a slightly toroidal stellarator, diffusion in a stellarator with collapsed magnetic surfaces, and others. (IAA)

Plasma Production

Refer also to abstract 13826.

13880 (AD-781127) RESEARCH ON PLASMA PRODUCED BY LASER-SOLID INTERACTION AND LASER PRODUCED PLASMA FOR THERMONUCLEAR REACTORS. Final Report, 1 April 1967–31 March 1974. Woo, J. T.; Fader, W. J.; Polk, D. H.; Haught, A. F. (United Aircraft Corp., East Hartford, Conn. (USA). Research Labs.). 31 May 1974. Contract F44620-67-C-0082. 64p. (UARL-N-950556-1; AFOSR-TR-74-0961). NTIS $3.75.

The properties of hot, dense plasmas produced by laser irradiation of an isolated solid particle suspended in vacuum were investigated and studies made of the use of such plasmas confined within a mirror magnetic field as the target for an energetic neutral beam to form a steady state fusion plasma. Theoretical analysis of the mechanism of plasma production and the role of local ionization and recombination on the properties of the afterglow plasma were performed and found to be in excellent agreement with experimental measurements of the time history of the plasma properties obtained from charge collectors, mass spectrometer, and line radiation diagnostics. Survey calculations were used to develop empirical formulas relating the irradiating laser characteristics to the properties of the resulting plasma over a wide range of initial particle size and laser heating conditions. (auth)

13881 (AD-781274) PLASMA INJECTOR FOR HTP REACTORS. Final Scientific Report, June 1971–March 1974. Seidl, M. (Stevens Inst. of Tech., Hoboken, N. J. (USA). Dept. of Physics). May 1974. 12p. (SIT-P283). NTIS $3.00.

A study was made of the feasibility of producing neutralized ion beams by accelerating the ions in a plasma sheath produced by the interaction of an electron beam with gas. This complex process was subdivided into three areas, beam-plasma interaction, plasma production, and formation of the plasma sheath, which have been studied in some detail. It was found that the hot electron distribution needed for supporting the plasma sheath can be obtained by beam-plasma interaction. More research is needed for the control of the potential profile in the sheath. (auth)

13882 (FRNC-TH-501) SPECTROSCOPIC STUDY OF A LASER-INDUCED HELIUM PLASMA. Influence of Collective Effects. Experimental Demonstration of Satellite Lines of Forbidden Transitions. Bretagne, J. (Paris-11 Univ., 91 - Orsay (France)). 1973. 228p. (In French). Dep. NTIS (US Sales Only) $14.50.

Thesis.

A spectroscopic study was carried out on a dense helium plasma created by focusing a laser beam. Special attention was paid to the influence of collective effects on the profiles of two partially degenerate lines of He, the 4471.5Å and 4921.9Å lines. The characteristics of the plasma investigated (electron density between 10^{16} and 10^{18} e/cm^3, electron temperature of a few electron volts) situate it at the limit of standard kinetic plasmas, with predominant binary collisions, and collective plasmas with coupling of atomic radiative transitions and self-excited plasma waves. The appearance of satellite lines of the forbidden transitions $4^3F \rightarrow 2^3P$ and $4^1F \rightarrow 2^1P$ was demonstrated. They correspond to the coupling of plasmons of frequency $\omega = \omega_p$ and electromagnetic waves associated with the above two forbidden transitions. The profiles observed for these satellites and the results concerning their intensity were interpreted in terms of non-thermal electrostatic fluctuations of the electron electric field. After a kinetic study of the HeI and HeII level populations it was possible to determine the influence of the various above reactions in the production of hot electrons. The superelastic collisions $He^+(2) + e \rightarrow He^+(1) + e$ are mainly predominent at the beginning of the post-discharge of the plasma. Using a Fokker-Planck model the form of the lectron velocity distribution function tail was deduced and the spectrum of the collective contribution to the fluctuating field was determined. The experiment also revealed a considerable change in the profile of the two lines studied in their central part (relative intensity of the allowed component P and the forbidden component I and difference between I and P) attributable to the influence of collective effects. (FR)

13883 (LA-5789-MS) TAMPED THERMONUCLEAR BURN OF DT MICROSPHERES. Mason, R. J.; Morse, R. L. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1974. Contract W-7405-eng-36. 9p. Dep. NTIS $4.00.

The thermonuclear yields and gains from highly compressed DT spheres tamped by high-Z shells are calculated for temperatures near and above ignition and for tampers up to 100 times more massive than the DT. It is shown that the dynamic and structural advantages of including pusher-tamper shells need not be significantly diminished by the reduction of total fuel mass in the target. (auth)

13884 (ORO-3819-6) COLLISIONLESS SHOCK STUDIES USING LASER-PRODUCED PLASMAS. Koopman, D. W. (Maryland Univ., College Park (USA). Inst. for Fluid Dynamics and Applied Mathematics). 1974. Contract AT(40-1)-3819. 19p. Dep. NTIS $4.00.

The primary goal of the program was to investigate phenomena in counterstreaming plasmas, employing a laser-produced plasma expanding into an ionized background. Plasma parameters, diagnostic apparatus, ionizing potential waves, collisional precursor and momentum coupling processes, and collisionless interactions in magnetic fields are reviewed, and citations to publications derived from the research program are given. (auth)

13885 (SAND-74-5471) ELECTRON BEAM FUSION TARGETS. Clauser, M. J. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 13p. (CONF-741073-1). Dep. NTIS $4.00.

From annual meeting of the Academy of Science; Las Vegas, New Mexico, USA (11 Oct 1974).

High power pulsed electron beams have recently been given serious consideration as a means of imploding spherical targets to produce controlled thermonuclear reactions. One of the central considerations in such proposals is the design of the targets which can be used for such purposes. Calculations were performed of the behavior of targets consisting of spherical, high density shells filled with DT gas. Attention was concentrated on shells that are thick enough that no significant beam energy can penetrate them. Calculations indicate that scientific breakeven will require several megajoules of beam energy to be deposited in a pulse length of about 10 ns. However, experiments testing the concept and producing significant quantities of thermonuclear reactions should be possible with electron beam accelerators now being designed or under construction. (auth)

13886 (UCRL-51609) FABRICATION OF THE GLASS MICROBALLOON LASER TARGET. Souers, P. C.; Tsugawa, R. T.; Stone, R. R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 12 Jul 1974. Contract W-7405-eng-48. 54p. Dep. NTIS $5.45.

The fabrication of the first LLL laser target designed for neutron yield is described. Glass microballoons loaded with hydrogen gas were used as targets. It was found that hydrogen permeability in glass decreased exponentially as the temperature and silica content decreased. Loaded hydrogen was measured destructively, but absolutely, with an ionization chamber; it was measured nondestructively, but relatively, with a proportional counter. The diameter and wall thickness of the microballoons were measured by helium fill of a batch, individual metallographic sectioning, and refraction and light interference techniques. (auth)

13887 MEASUREMENTS OF ENERGETIC X RAYS FROM LASER-PRODUCED PLASMAS. Young, F. C. (Naval Research Lab., Washington, DC). Phys. Rev. Lett.; 33: No. 13, 747-750 (25 Sep 1974).

The dependence of energetic x-ray emission from laser-produced plasmas on laser energy, pulse duration, and atomic number of the target (Z = 4 to 42) was studied for irradiations of 10^{13} to 10^{16} W/cm^2. Energetic x-ray emission is more than 10^3 times greater than bremsstrahlung expected for a Maxwellian electron velocity distribution and is more sensitive to energy density in the target than to power density. (auth)

13888 X-RAY EMISSION FROM LASER-PRODUCED PLASMAS. Nagel, D. J.; Burkhalter, P. G.; Dozier, C. M.; Holzrichter, J. F.; Klein, B. M.; McMahon, J. M.; Stamper, J. A.; Whitlock, R. R. (Naval Research Lab., Washington, DC). Phys. Rev. Lett.; 33: No. 13, 743-746(25 Sep 1974).

Several characteristics of the x-ray emission from plasmas produced at the focus of a high-power (~10 GW) laser were measured. X-ray spectra in the 1 to 2-keV region show that the plasmas contain highly stripped atoms (10-12 electrons missing from Al, 20-22 from Zn, and 36-38 from Gd). The laser-plasma x-ray source can emit about 0.1 J of x rays above 1 keV in 1 nsec from a volume about 100 μm in diameter. This corresponds to more than 10^{13} W/cm^3. (auth)

13889 THERMONUCLEAR MICROFISSION. Winterberg, F. (Univ. of Nevada, Reno). Nucl. Sci. Eng.; 56: No. 1, 83-84(Jan 1975).

The consequences of igniting a small fissionable pellet by laser-beam or relativistic electron-beam induced high density implosion-compression on future reactor technology are discussed. It is shown that with this method a highly efficient reactor system becomes possible by direct magnetohydrodynamic conversion of the expanding fireball into a magnetic cavity. The method not only will lead to an "absolutely" safe fast breeder reactor but by using hybrid pellets consisting of a combination of both fissionable and fusionable materials in addition will also lead to a combined fission-fusion energy producing system. In such a fission-fusion hybrid system, whereby the fission process produces a large amount of heat and the fusion process produces a large number of neutrons, the bootstrap coupling between the fission and fusion processes greatly increases the rate of the ensuing chain reaction and hence energy output enhancing substantially the energy yield of the micro-explosions. (auth)

13890 LASERS BLAST A SHORTCUT TO THE ULTIMATE ENERGY SOLUTION. Lessing, L. Fortune; 89: 221-223(May 1974).

The problems inherent in developing a thermonuclear fusion process suitable for solving mankind's energy crisis by means of the containment method can possibly be avoided by a new approach in which lasers are used to heat tiny pellets of deuterium and tritium to temperatures at which fusion takes place. Techniques are being considered to hit the pellet simultaneously on all sides by laser beams. The vaporization of the pellet's surface would set off an implosion in the interior of the pellet. The resulting compression of the pellet core would make it possible to achieve fusion with 100,000 times less laser energy than that required according to previous estimates. Progress in the further development of this very promising process appears to be impeded by the secrecy in which much of the work on controlled laser fusion is being conducted and by inadequate financing. (IAA)

Plasma Stability

Refer also to abstract 14933.

13891 (COO-3077-60) STABILITY OF A CLASS OF BIFURCATED, MAGNETOHYDRODYNAMIC FREE BOUNDARY EQUILIBRIA. Kappraff, J. (New York Univ., N. Y. (USA). Courant Inst. of Mathematical Sciences). Jun 1974. Contract AT(11-1)-3077. 62p. Dep. NTIS $6.25.

The ideal magnetohydrodynamic free boundary model is employed to study the bifurcation of a family of helically symmetric equilibria. The equilibria are intended to approximate the stellarator experiment with low plasma pressure and L = 2 helical symmetry. The study is carried out in a plasma column of finite length, surrounded by a vacuum region, all enclosed within an outer conducting wall. The straight helical equilibria are obtained by expansion in two parameters, c and ϵ, the ratio of the helical magnetic field to the theta pinch field, and the product of the helical wavenumber times the plasma column radius, respectively. The distortion of the plasma column from a true cylinder is taken to be small of order c. The column length is chosen to avoid "kink instabilities" for some range of aximuthal wave-numbers, n, for which the theory applies, and the critical beta is obtained. At this beta, a marginally stable state of principally n = 1 long wavelength mode is determined and serves as the starting point for bifurcation. The stability analysis is based on a determination of the sign of the second variation of the potential energy. Neighboring bifurcated equilibria are found by expanding the fields in another small parameter. The bifurcated equilibria are found to be stable when the conducting wall is within 1.15 plasma column radii of the plasma vacuum interface. This position was not sufficient to stabilize the original equilibrium. (auth)

13892 (EUR-CEA-FC-735) NUMERICAL INVESTIGATION OF MHD STABILITY IN AXIALLY SYMMETRIC CONFIGURATIONS FOR ANY CROSS SECTIONS. Weisse, J.; Grelot, P. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Grenoble, 38 (France). Groupe de Recherches sur la Fusion Controlee; CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Service d'Ionique Generale). Apr 1974. 77p. (In French). Dep. NTIS (US Sales Only) $7.00.

The MHD equilibrium and stability of an axisymmetric toroidal plasma in a Tokamak-like configuration with noncircular cross section was studied. A special family of shell shapes was considered. The results obtained when using a flat current profile (J nonequal to zero on the boundary) are compared with those obtained with a parabolic profile (J = 0 on the boundary). (FR)

13893 (IPPCZ-181) NONLINEAR BEAM-PLASMA INTERACTION. Jungwirth, K.; Sunka, P. (Ceskoslovenska Akademie Ved, Prague. Ustav Fyziky Plazmatu). Jun 1973. 62p. INIS.

The nonlinear evolution of hf instabilities excited by an electron beam in a magnetized plasma was investigated theoretically and experimentally. Only the Cherenkov type of excitation ($\omega \approx k, v_b$) of the electron plasma oscillations was observed. Using the energy and the momentum conservation laws, equations describing the development of the amplitude and the phase of the most unstable wave were derived both for the temporal and the spatial problems and then solved numerically together with equations of the beam particles motion. (auth)

13894 (LA-5788-MS) PRELIMINARY $l_{1,0}$ FEEDBACK FORCE EXPERIMENTS ON SCYLLA IV-3. Ellis, W. R.; Gribble, R. F.; Harder, C. R. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1974. Contract W-7405-eng-36. 6p. Dep. NTIS $4.00.

Experimental results are reported with the $l_{1,0}$ feedback system developed for Scyllac. An l = 1 field component when added to the normal Scylla IV-3 straight theta pinch induced an m = 1 plasma instability whose motion could be either reversed or enhanced by an appropriate choice of polarity of the l = 0 feedback fields. The feedback field was generated by ten power-amplifier modules. A position detector was not used in these experiments, and the feedback loop was not "closed". (auth)

13895 (UCID-16664) INSTABILITY-THRESHOLD DATA FROM THE BASEBALL II VACCUM-BUILDUP EXPERIMENT. Foote, J. H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 30 Dec 1974. Contract W-7405-eng-48. 45p. Dep. NTIS $5.25.

The instability-threshold data from the Baseball II vacuum-buildup experiment are now extensive, and the parameter range covered by these measurements is large. The agreement with the Baseball I threshold results is poor. Although some of the thresholds lie near the Baseball I average-threshold line and its extension on an $\epsilon = (\omega_{pi}/\omega_{ci})^2$ vs $e\phi/W_i$ plot, many fall considerably below. The large spread in the data, when plotted in this way, is well outside the estimated experimental uncertainty. The data scatter evidently is not due to gross inaccuracies in these measurements, i.e., a plot of the combined Baseball I and Baseball II threshold data shows a strong and reasonably well-defined variation of density with plasma potential. This variation is apparently a manifestation of the classical collisional relations, which must be satisifed even for instability-threshold data. Selected sets of Baseball II threshold data, obtained when experimental conditions were held almost constant except for one particular parameter, show a strong variation of ϵ with $e\phi/W_i$. This variation is in agreement with the classical equations but in disagreement with the Baseball I ion-cyclotron-instability theory. There is no satisfactory explanation for the Baseball II threshold data at this time. The quantity $e\phi/W_i$ appears to be no longer the controlling parameter for the instability. However, the threshold and maximum (instability-limited) densities do seem to vary approximately as the square of the magnetic-field magnitude, indicating that ϵ ($\propto n_i/B^2$) is still important. (auth)

13896 INSTABILITY OF A COLLISION PLASMA IN A MIRROR TRAP. Kanaev, B. I.; Yushmanov, E. E. (Inst. of Atomic Energy, Moscow). Zh. Eksp. Teor. Fiz.; 67: No. 2, 586-600(Aug 1974). (In Russian).

The aim of the present work was to investigate the possibility of stable confinement of a plasma in a mirror trap by employing a model which imitates the reactor state with allowance for the main requirements of similarity. A hot ion plasma with $n \approx 10^{12}$ cm^{-3} and $E_i \approx 100$ eV, which freely decays in a magnetic hole, is studied. It is found that decay first takes place in accordance with the classical model for Coulomb scattering without exhibiting any serious anomalies. Subsequently, however, an intense instability of the ion-cyclotron type arises which results in large ion losses, anomalous electron heating and other macroscopic effects. Development of instability is closely connected causally with the plasma ambipolar potential. The instability is identified as a drift-cone mode which, however, requires greater deformation of the distribution function than in the case of a simple loss cone. (auth)

13897 VELOCITY SPACE INSTABILITIES FOR ION BEAMS TRAVERSING PLASMAS. Gaffey, J. D. Jr. San Diego, CA; Univ. of California (1974). 150p. University Microfilms Order No. 74-27,560.

Thesis (Ph. D.).

The results of several distinct but closely related calculations are presented. The instability of the ordinary electromagnetic mode is discussed for counterstreaming plasmas, counterstreaming ions with stationary electrons, and ion beams counterstreaming through a background plasma of stationary electrons and ions. The dispersion relations for electromagnetic and electrostatic waves propagating perpendicular to the magnetic field are considered in the limit as the magnetic field strength approaches zero. These methods are applied to a space physics problem, the determination of the electron density in the magnetosphere by measuring the upper hybrid resonance. Finally, a steady state solution to the Fokker–Planck equation is found and the stability of this distribution is analyzed for fast ion beams traversing magnetized plasmas. (Diss. Abstr. Int., B)

13898 NUMERICAL STUDIES OF RESISTIVE INSTABILITIES IN DIFFUSE PINCHES. Dibiase, J. A. Davis, CA; Univ. of California (1974). 244p. University Microfilms Order No. 74-29,300.

Thesis (Ph. D.).

A hydromagnetic model was developed to study resistive instabilities in cylindrical geometry, and the model is applied to study specific diffuse pinch configurations. The MHD equations include the effects of compressibility, finite resistivity, viscosity, and thermal conductivity. The plasma equilibrium configuration is assumed known and is specified by $B_{z0}(r)$, $B_{\theta 0}(r)$, $\eta_0(r)$, $\rho_0(r)$, $T_0(r)$ and these functions can be chosen to describe a particular experiment. Perturbations of the form $f_1(r,t)e^{i(m\theta + kz)}$ are used for all plasma and field variables, and the resulting linear partial differential equations are solved numerically as an initial value problem using an implicit difference scheme. A set of six equations for B_{r1}, $B_{\theta 1}$, T_1, v_{r1}, $v_{\theta 1}$, v_{z1} is obtained and the calculation is started by specifying an initial perturbation. An incompressible resistive model without dissipation is also developed, resulting in a set of four equations in B_{r1}, $B_{\theta 1}$, v_{r1}, $v_{\theta 1}$. For a particular problem, the parameters m, k_z, and $S = \tau_R/\tau_H$, the ratio of resistive diffusion time to hydromagnetic transit time must also be given. For certain cases an exponential growth occurs and the growth rate $p(m,k_z,S)$ is calculated. The model can be used to test equilibrium configurations against both tearing and rippling modes. Extensive parametric studies have been done for the tearing mode using a force-free Bessel function model, a high-beta reversed field model, and 3 tokamak-type models in which the axial field does not reverse direction. Results for the tearing mode using the Bessel function model agree with analytic theory, and the outer conducting wall R_w must be placed approximately 2% closer to the plasma to insure stability against resistive tearing modes as well as ideal MHD modes. For the high-beta reversed field model, complete stability against resistive tearing modes for positive k_z values requires R_w approximately 22% closer to the plasma than the MHD stability criterion, while complete stability for negative k_z values requires R_w about 50% closer. For both reversed field models, resistive tearing instabilities are found where no ideal MHD instabilities exist. The tokamak models are found to be resistively unstable for large values of m; the stability windows of the infinite conductivity case are replaced by regions of low growth rate, and there is considerable overlap of the azimuthal modes. For all configurations tested, true resistive tearing modes seem to occur only for $S \gtrsim 10^4$ to 10^5. The infinite conductivity case is also tested and the results agree well with analytic theory. The model can thus be applied to study both the MHD and resistive instability of a wide class of equilibrium configurations in cylindrical geometry. (Diss. Abstr. Int., B)

13899 STABILIZATION OF TRAPPED-ION INSTABILITY IN TWO-COMPONENT TORUS. Berk, H. L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Phys. Lett., A; 50: No. 1, 65-66(4 Nov 1974).

The trapped-ion instability in a two-component torus reported by Ohkawa and Bhadra is stabilized with an extremely small spread in the drift velocity. (auth)

13900 WATER BAG STABILITY THEORY FOR PLANAR BOUNDED PLASMAS WITH COUNTERSTREAMING ELECTRON INJECTION. Hu, K. M. University Park, PA; Pennsylvania State Univ. (1974). 129p. University Microfilms Order No. 74-28,963.

Thesis (Ph. D.).

Stability properties associated with two kinds of counter-streaming injected electron planar diodes are studied. A two-bag water-bag model analysis is adopted to investigate the effects of the thermal spread of the electron beams and the presence of background electrons. In the first case a nonneutral diode with the presence of a potential well inside is studied. This system simulates a spherical electrostatic confinement device. For mathematical simplification, reflecting wall boundary conditions are adopted. It is found that the coupling of the higher order modes always leads to high frequency instabilities with extremely small growth rates. The origin of these instabilities is associated with using a finite number of water bags. The stability properties of the dominant instabilities of the system are investigated. For narrow beams and a low density of background electrons, it is found that no deep potential well is stable. However, as the density of the background electrons increases, certain ranges of stable deep potential wells exist. The second case, a completely neutralized diode is analyzed. Both reflecting wall and absorbing wall boundary conditions are studied. The electron distribution function is characterized by two dimensionless parameters a and A which are associated with the thermal spread of the beams and the amount of background electrons. The stability properties have similarities for the two boundary conditions. In both cases, a sufficient condition for stability is $a \geq A$. For $a < A$, both possess the same minimum diode length for instability. When the diode length is greater than this minimum value, the system in unstable. At integral multiples of this minimum diode length, a new unstable mode occurs for both boundary conditions. The difference

lies in the result that in the absorbing wall case, once an unstable mode occurs at some diode length, its growth rate increases as the diode length increases and asymptotically approaches a maximum value as the diode length goes to infinity. For the reflecting wall, the growth rate associated with a specific mode always rises to a maximum, then decreases to zero as the diode length goes to infinity. In the absorbing wall case, the first unstable mode is always the dominant mode for any length where instability can occur. For the reflecting wall, as the length increases, the dominant unstable mode successively shifts to the next higher mode as the length increases. The dominant growth rate is similar for both boundary conditions. (Diss. Abstr. Int., B)

Thermonuclear Engineering and Equipment

Refer also to abstract 13831.

13901 (BNWL-1842) HELIUM COOLANT COMPATIBILITY WITH CANDIDATE FUSION REACTOR STRUCTURAL MATERIALS. Charlot, L. A.; Westerman, R. E. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 15 Jul 1974. Contract AT(45-1)-1830. 38p. Dep. NTIS $4.00.

The study includes the following: thermodynamic free energies of compound formation for oxides, carbides, and nitrides of niobium and molybdenum; terminal solubility data for the compound phase-solid solution; and pressure-temperature-composition for contaminant/solid solution equilibria. Also included is a summary of diffusivity data for oxygen, nitrogen, and carbon in niobium and molybdenum, since these kinetic data relate to the distribution of contaminant within the metal. The effects of bulk metal corrosion and interstitial contaminants on the mechanical properties of stainless steels, niobium- and molybdenum-base alloys are summarized. Some containment/environment criteria are summarized. (MOW)

13902 (BNWL-SA-5069(Rev.)) INTERESTING POSSIBILITIES OF FUSION-FUSION. Werner, R. W.; Lee, J. D.; Moir, R. W.; Carlson, G. A.; Peterson, M. A.; Wolkenhauer, W. C.; Leonard, B. R. Jr. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 30 Sep 1974. 12p. (CONF-741105-47; UCRL-75527; IAEA-CN-33/G6-1). Dep. NTIS $4.00.

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

The hybrid reactor, a fusion plasma source driving a subcritical fission assembly, is discussed. Hybrids combine neutron-rich but power-poor fusion, with power-rich but neutron-poor fission. Hybrids may be realizable before pure fusion since they substantially relax the plasma and engineering requirements. A fissile blanket could be designed with one or more of the following primary goals: energy amplification in a power reactor, production of fissionable fuel, and/or an interim system in the development of pure fusion. Lawrence Livermore Laboratory and Pacific Northwest Laboratory have undertaken several hybrid studies including fast fision blankets, thermal blankets, and fusion systems with power production as the primary goal. Present blanket studies have concentrated largely on neutronic performance, and energy multiplication in the 7 to 40 range has been demonstrated. Beyond the ability of the blanket to energy multiply, it is necessary that many other design requirements be satisfied, such as structural, heat transfer and economics. Accessibility of the blanket for servicing is very important. System components other than the blanket must also be considered. A complete design study has been started in order to determine whether the hybrid can be economically competitive and environmentally acceptable in a time period that precedes pure fusion. (auth)

13903 (CEA-CONF-2711) HIGH VOLTAGE AND CURRENT SUPPLY FOR NEUTRAL INJECTORS. Bariaud, A. R.; Bonnal, J. F.; Dei-Cas, R.; Rebut, P. H.; Lisser, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). [nd]. 5p. (CONF-740630-6). Dep. NTIS (US Sales Only) $4.00.

From 8th symposium on fusion technology; Noordwijkerhout, Netherlands (17 Jun 1974).

To increase the plasma temperature of the TFR Tokamak at Fontenay-aux-Roses, the method of injection of fast neutral beams is described. High voltage and current power supplies to accelerate ions produced by ion sources before neutralization were defined for this special purpose. Each unit can deliver 60 kV, 20 A and feeds two lines of injectors. As the injection time is pulsed during 200 ms every 2 minutes, an electronic device was studied to restore the voltage after application of the current and also to protect the electrodes and the supplies when breakdown occurs between the electrodes. (auth)

13904 (CEA-CONF-2712) PROTOTYPE OF THE FAST NEUTRAL INJECTOR TO TFR. Becherer, R.; Bonnal, J. F.; Dei-Cas, R.; Druaux, J.; Oberson, R.; Torossian, A. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). [nd]. 9p. (CONF-740630-7). Dep. NTIS (US Sales Only) $4.00.

From 8th symposium on fusion technology; Noordwijkerhout, Netherlands (17 Jun 1974).

To obtain a significant increase in temperature in the TFR, the injection of about 300 kW of fast neutral hydrogen beams at energies between 30 and 50 kV is planned using two lines of injection, each line composed of 5 sources. A prototype was built to test the engineering aspects of the construction and the performance of one neutral beam in experimental conditions as close as possible from those which will exist in TFR. A description of the main elements of the experimental facility and a discussion of the working parameters are given. (auth)

13905 (EUR-CEA-FC-734) DETERMINATION OF THE CHARACTERISTICS OF A D^- ION SOURCE FOR A 10 MW TO 1 MeV NEUTRAL INJECTOR. Jacquot, C. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Groupe de Recherches sur la Fusion Controlee; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). Apr 1974. 26p. (In French). Dep. NTIS (US Sales Only) $4.50.

The characteristics of a D^- ion source were determined in order to define a project of neutral injector (10MW-10A-1MeV). The various ion sources now available are compared. (FR)

13906 (GA-A-13184) CONTROLLED THERMONUCLEAR RESEARCH PROGRAM. Summary Progress Report, August 1, 1973-June 30, 1974. (General Atomic Co., San Diego, Calif. (USA)). 15 Sep 1974. Contract AT(04-3)-167. 280p. Dep. NTIS $7.60.

The research areas discussed are the Doublet II and Doublet IIA experiments, the dc Octopole experiment, helium cooling study for fusion reactors, noncircular cross-section FTR study, and the theoretical studies related to the above subjects. The experiments with the Doublet II device were concluded in February 1974 and the device was disassembled for the modification into Doublet IIA. Doublet-shaped plasmas with parameters similar to tokamak plasma were obtained. Since a modest value of the toroidal magnetic field (less than 10 kG) was used, the results were encouraging in supporting the theoretical projection of the advantages for noncircular cross sections. The objectives for conversions are (1) better diagnostic accessibility, (2) shaping by external coils instead of a field shaper, and (3) comparative study of various shapes. The conversion was completed by the end of July 1974. The device is being debugged and tested. The Octopole devices continue to be productive. A new type of transport scaling (Bohm in poloidal magnetic field) was found experimentally. Subsequently the device was used to simulate the tokamak plasma with a divertor. Configurations bounded by the separatrix away from the wall were obtained. They are found to be stable until the value of the safety factor becomes low enough to cause disruptive instability similar to the standard tokamak plasmas. A theoretical model has been developed to explain the instability. The helium cooling study showed that the stagnant lithium blanket may be cooled by helium in tubes without increasing the volume significantly. A conceptual design study was made on noncircular cross-section FTR. The assumption of the theoretical advantage of noncircular cross section leads to the conclusion that a device with a similar cost as circular TCT FTR will become an injection device, owing primarily to higher plasma density. (auth)

13907 (IAE-2284) SUPERCONDUCTING SOLENOID FOR LIN-5. Bezbatchenko, A. L.; Keilin, V. E.; Klimenko, E. Yu.; Kovalev, I. A.; Maksimenko, R. P.; Maslennikov, E. A.; Novikov, S. I.; Panov, D. A.; Semashko, N. N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1973. 24p. (In Russian). INIS.

A superconducting solenoid creating a magnetic field with simple corkscrew configuration with intensities up to 24 kG in the center, 50 kG in the mirror, and 58 kG on the internal surfaces of the superconducting wiring was calculated, designed, fabricated, and tested. The solenoid was to be used for the magnetic trap in the LIN-5 injector. The size and configuration of the magnetic field complies with conditions for making plasma-physics experiments for the study of the possibility of plasma storage and confinement during suppression of channel instabilities of the feedback system. (tr-auth)

13908 (IPP-1-143) NEUTRON FLUX DISTRIBUTION ON THE WALL OF TOROIDAL CONTROLLED THERMONUCLEAR REACTOR DEVICES WITH ELONGATED CROSS SECTION. Becker, G.; Wunderlich, P. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F.R. Germany)). Feb 1974. 10p. INIS.

The neutron flux distribution on the wall of a toroidal CTR device with strongly elongated cross section was calculated. On the inner and outer cylindrical walls (belt-pinch device) the flux distribution has a plateau region with a half-width equal to about the height of the plasma. The maximum flux is found on the outer cylinder and in the symmetry plane ($Z_0 = 0$). The neutron flux asymmetry and reduction eta of the mean wall loading are determined. For standard data, an eta of 57% is computed. This is mainly due to the flux profiles on the cylindrical walls and does not depend sensitively on the toroidal curvature. For standard parameters, the inner cylinder absorbs 22.6%, the outer cylinder 68.6% and the end plates together 8.8% of the total neutron emission. The corresponding values for a straight device with the same coil and plasma cross section are 44%, 44%, and 12%. A reduction of toroidal curvature diminishes flux asymmetry between the inner and outer cylinders. The maximum flux and minimum eta-value are obtained at a large torus radius equal to two times the coil width. (auth)

13909 (IPP-4/114) HIGH-VOLTAGE PULSE GENERATORS. Klement, G.; Wedler, H. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F.R. Germany)). Mar 1974. 59p. (In German and English). INIS.

The pulse generators were developed as a standard series. The design was concerned with low inductance, but rather with simple construction and low price. For each of four different types of capacitors one-to-five-stage generators were developed and tested. The data of the individual types of generators are listed in table form and a few oscillograms for typical applications are presented. The jitter and delay as a function of the charging voltage show the range of operation. The above information is completed by individual circuits. The components used, such as spark gaps, pulse transformer, shorting facilities etc. were also developed at IPP. The manufacturer's data and test results are presented in separate tables for the pulse cables and pulse capacitors. (auth)

13910 (IPP-4/117) MAGNETIC IRON-CORE MODEL AND STRAY FIELD MEASUREMENTS FOR PULSATOR I AND THEIR RELEVANCE TO JET. Gernhardt, J.; Herppich, G.; Werner, P. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F.R. Germany)). Feb 1974. 7p. (AED-CONF-74-162-001). INIS.

Results of the measurements at the Pulsator I iron core magnetic model are compared with the stray field measurements at the original core. Special regard is given to plasma simulation. Outlines for a JET model are presented. (auth)

13911 (LA-UR-74-1861) PROSPECTS FOR CONVERTING ^{232}Th TO ^{233}U IN A LINEAR THETA-PINCH HYBRID REACTOR (LTPHR). Krakowski, R. A.; Dudziak, D. J.; Oliphant, T. A.; Thomassen, K. I.; Bosler, G. E. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 97p. (CONF-741220-1). Dep. NTIS $8.00.

From fusion-fission energy systems meeting; Washington, District of Columbia, USA (3 Dec 1974).

The consequences of plasma end losses on the overall energy balance for a linear theta-pinch reactor can be ameliorated by use of a fission-enhanced, energy-multiplying blanket. This study is concerned with the constraints established by plasma physics, neutronics, energy balance, and economics on the design of a Linear Theta-Pinch Hybrid Reactor (LTPHR); although preliminary in nature, this study integrates these four important requirements in a consistent way. Although neutronically inferior to the ^{238}U/^{239}Pu fuel cycle the ^{232}Th/^{233}U fuel cycle has been selected by this study on the basis of (potential) environmental advantages. Only present, well-understood technology for both the fission (HTGR) and fusion (Scylla) aspects of the LTPHR is evoked. On the basis of a generalized energy balance developed for the fission-fusion symbiosis, favorable (Q_E = total electrical power/recirculated power ~ 5-10) energy multiplication results for theta-pinch systems which are below 1000 m in length and self-sufficient for tritium. Although some ^{233}U-enrichment of the blanket is shown to be necessary, the optimum (minimum inventory for maximum energy multiplication) blanket configuration is yet to be evolved. An electrotechnology based on LC-resonant circuits is proposed, and reversible transfer of magnetic energy with efficiencies > 90% will be required. Although the mix between fission and fusion energy production is not specified, the fusion portion of the symbiosis is required to generate electrical power at a minimum level to satisfy internal energy losses. Preliminary cost estimates of major portions of the "nuclear island" (power supplies, switches, blanket, prorated fission burner) indicate costs in the range of 800 $/kWe for the highly (^{233}U) enriched systems. A major cost for the LTPHR (400-500 $/kWe) is associated with the capacitive power supply, and alternative magnetic energy storage schemes will be explored. Typically a 1000 m long LTPHR which has a 50 kg/m ^{233}U loading gives an intrinsic doubling time of 5 y (~ 10^4 kg/y ^{233}U production) for a first-wall, fusion neutron current of 4.0 MW/m^2. This system has a net tritium breeding gain, generates 6-7 times its internal circulating power needs (for reversible transfer efficiency of 95%), and provides 20 MWe/m of electrical energy (6.4 MWe/m^3 or 2.5 kg-^{233}U/MWe) for a thermal conversion efficiency of 0.40; approximately 10 GJ of stored energy will be required, which must be switched at a frequency of 25 Hz to maintain a 4.0 MW^2/m^2 fusion neutron wall loading. The design present here in many ways is conservative, but these preliminary, favorable results warrant further exploration of the LTPHR concept. (auth)

13912 FUSION POWER TEAMS BEGIN TO TACKLE THE ENGINEERING TASKS. Olds, F. C. Power Eng.; 78: No. 10, 34-41(Oct 1974).

The concept of the UWMAK-1 fusion reactor from the University of Wisconsin Fusion Feasibility Study Group is described. The reactor burns deuterium–tritium plasma, uses lithium for the blanket and blanket coolant, breeds tritium from the lithium, and has a power rating of 5000 MWt/1500 MWe. The plasma radius is 5 m and the major radius of the torus is 13 m. The core structural material is largely 316 stainless steel and this includes the first wall (the torus shell which sees the plasma). The superconducting magnets are NbTi cryogenically stabilized with copper. The energy given off by the fusion reaction will be largely in the form of high energy (about 14.1 MeV) neutrons. The energy is picked up in the lithium blanket as heat and transferred to the secondary system by an intermediate heat exchanger. The secondary fluid is sodium. It passes through a sodium–water heat exchanger where steam is generated. Gaps in knowledge about fusion reactions include most aspects of large superconducting magnets, almost everything about 14-MeV neutrons and their effects on the first wall; on-line fuelling of a 100-million-degree plasma; keeping the plasma clean; helium stripping; differential thermal expansion; and pumping red hot lithium through strong magnetic fluids. (MCW)

13913 SIMPLE, MULTIPLE ARC, DIELECTRIC SWITCH APPLIED TO A THETA PINCH. Nunnally, W. C.; Kristiansen, M.; Hagler, M. O. (Texas Tech. Univ., Lubbock). Rev. Sci. Instrum.; 45: No. 11, 1361-1364(Nov 1974).

The construction and the operating details of a simple, field distortion, dielectric switch first used by Martin at A.W.R.E. and later extensively investigated by Dokopoulos at Jülich are presented. The switch, triggered by a small, fast Marx circuit, holds off approximately 110 kV and switches 70 kV at 500 kA with an inductance of 12 nH. The switch produces multiple arcs through the switch package without meticulous switch package preparation, with pitted and scarred switch electrodes, and with a relatively slow trigger system. The dielectric switch is used in a fast theta pinch system and is designed to facilitate ease of operation, switch package preparation, and repeatable performance. (auth)

13914 NUCLEAR FUSION DEVICE. Sato, K.; Wase, K. (to Hitachi Ltd.). Japanese patent 1973-24597/B/. 9 Mar 1970. 4p. (In Japanese).

The present invention relates to an apparatus for nuclear fusion in which a circular coil is equipped in a vacuum vessel. The purpose of the invention is to provide apparatus satisfying the following requirements: A coil support must have adequate mechanical strength. The support member of the coil support must have a limited section. Both the coil support and the support member must be insulated from the vacuum vessel. The coil support must be capable of adjusting the position of the coil, be insulated from plasma, and further be non-magnetic. In the apparatus for nuclear fusion, a coil support in the form of a bar made of a non-magnetic material of high tension and covered with insulating film on the outer periphery is provided between the coil support and the coil. The terminal section at the side of a coil support member of the bar-like coil support is clamped to the former coil through the insulator. Thus, the above requirements are satisfied, as far as the present invention relates to the apparatus for nuclear fusion, in which the circular coil wound by the coil support to a desired form is equipped together with the support member in the circular vacuum vessel. (JA)

13915 PROCESS FOR MANUFACTURING A VACUUM CONTAINER FOR USE IN A NUCLEAR FUSION APPARATUS. Wase, K.; Sato, K. (to Hitachi Ltd.). Japanese patent 1973-14998/B/. 19 Jun 1970. 3p. (In Japanese).

The purpose of this invention is to provide a process for manufacturing a nuclear fusion apparatus vacuum container which is highly accurate and easy to manufacture. According to the invention, a plate material is pressed to shape a U-shaped semi-circular section, which is converted into a perfect semi-circle by mechanical means. The thus formed semi-circular containers are joined by welding a joint between them to form a perfect circular container. The circular vacuum container inserted by a coil or similar means is required to be divided in two. The thus vertically divided semi-circular containers are welded with flanges to form an appropriate groove for vacuum sealing by mechanical work of the welded flange surface to be made into the semi-circular containers with flanges. The vacuum container for use in a nuclear fusion apparatus consists of the above divisible containers joined with bolts. Thus the purpose of this invention is accomplished by a perfect circular container divided in two, each with the addition of a flange, through a process of press shaping, mechanical work and welding of a simple plate material, and is therefore highly accurate. (JA)

13916 TWO-DIMENSIONAL MAGNETOHYDRODYNAMIC MODEL OF THE Z-PINCH PLASMA FOCUS. D'iachenko, V. F.; Imshennik, V. S. Vop. Teor. Plazmy; No. 8, 164-246(1974). (In Russian).

An MHD model for nonsteady-state plasma compression in a Z-pinch is set up, and solved numerically. Subjects discussed are the formulation of the MHD problem for a noncylindrical Z-pinch, description of the dissipative processes, two-dimensional MHD equations, the energy conservation law and the equation of electrical engineering, initial and boundary conditions, dimensionless form of the equations, improved formulation of the MHD problem; numerical methods of solution, free-point method, choice of points, method of deriving difference relations, computational formulas, numerical modeling of the boundary conditions; results of the calculations, convergence of a shock wave and a current shell on the axis of the system, first and second compressions of the plasma, instabilities at the plasma-magnetic field boundary, and the energy balance and neutron yield from a plasma focus. (IAA)

13917 PLASMA CONFINING DEVICE. Imura, Y.; Saito, T.; Miyamoto, K. (to Hitachi Ltd.). Japanese patent 1973-15840/B/. 30 Sep 1970. 3p. (In Japanese).

In a plasma confining device, it is necessary to induce a strong magnetic field and at the same time, a stabilized magnetic field free from disturbance. However, the magnetic field may be disturbed in the conventional apparatus with a winding of helical coils on the circuit discharge tube, which only results in a complex which is comprised to prevent the magnetic disturbance. The plasma container which aims to overcome the above defects has a hollow circular discharge tube on which a helical coil is wound on its exterior circumference. The plasma is confined in the vacuum tube, being the hollow discharge tube. In the embodiment it was that the helical coil wound in the same pitch having a definite number of windings on the circular tube was adapted to allow the windings to return to the same starting point where the feeding lead is positioned. (JA)

13918 MULTIPOLE COILS FOR A NUCLEAR FUSION DEVICE. Hozuki, J.; Wase, K. (to Hitachi Ltd.). Japanese patent 1973-7030/B/. 6 Feb 1970. 2p. (In Japanese).

This invention relates to multipole coils for a nuclear fusion reactor. These coils were designed to generate a magnetic field for confining the plasma. A plurality of coils made of electrically conductive material are disposed in an annular pipe of anticorrosive material such that they may be securely held in place by spacers made of a heat-resisting material such as a ceramic material. Over the entire external surface of the annular pipe, an insulating layer is applied by a winding of insulating film or mica paper, or otherwise by a synthetic resin molding. In turn, this insulating layer is covered with an electric conductive layer made of, for example, electrically conductive paint, aluminum foil or tin foil, and then the electric conductive layer is grounded. By such arrangement, a high voltage impressed between the annular pipe and those of the coils on the outermost array is avoided, and therefore the surface of the insulating layer is not charged. Thus, this arrangement is free from the problem of insulation between the annular pipe and the coils. In addition, cooling within the annular pipe can be achieved simply by circulating pure water or a gas such as air or nitrogen. (JA)

Wave Phenomena

13919 (CONF-730906-15) LINEAR AND NONLINEAR TRANSFORMATION OF ELECTROMAGNETIC WAVES IN PLASMA. Batanov, G. M.; Golant, V. E. (AN SSSR, Moscow. Fizicheskij Inst.). 1974. 61p. (In Russian). Dep. NTIS (US Sales Only) $6.25.

From 11th international conference on phenomena in ionized gases; Prague, Czechoslovakia (10 Sep 1973).

A review is presented of the experimental studies of processes of transformation of waves in plasma with low frequency of collision. Special attention is given to studies on the effect of the processes of linear and nonlinear transformation in wave absorption. The first part of the review is devoted to studies under conditions where linear transformation of electromagnetic waves, introduced into the plasma, into slow plasma waves is possible. In the second part the dissipation of energy and the heating of plasma during parametric excitation of the plasma oscillations by electromagnetic waves introduced in the plasma are examined. (auth)

13920 (EUR-CEA-FC-736) NONLINEAR INTERACTION NEAR THE UPPER HYBRID RESONANCE. Mendonca, J. T. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Groupe de Recherches sur la Fusion Controlee; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). May 1974. 19p. (In French). Dep. NTIS (US Sales Only) $4.00.

The extraordinary wave propagating through an inhomogeneous plasma and encountering a hybrid resonance is partially converted into a longitudinal wave. An experimental study of the scattering of a laser beam by the electron density fluctuations related to the extraordinary mode is envisaged. A theoretical discussion of the possibilities of such an experiment is suggested from the study of the nonlinear interaction of a high frequence probing wave with the extraordinary mode near the resonance. (FR)

13921 (NP-20263) NONLINEAR STATISTICAL THEORY OF LANGMUIR CONDENSATE. Khakimov, F. Kh.; Tsytovich, V. N. (AN SSSR, Moscow. Fizicheskij Inst.). 1973. 60p. (In Russian). Dep. NTIS (US Sales Only) $6.00.

The problem of Langmuir condensate was examined in general as an introduction to specific considerations from three aspects. The first specific aspect considered was the nonlinear interaction of the plasmas with the condensates. The study showed that in the nonlinear stage of modulation instability the formation of condensate of Langmuir plasma leads to another important effect consisting of a change in intensity and a change of the direction of the spectral transfer of the high-frequency oscillations which in itself leads to nonlinear attenuation of the condensate because of the transformation of the oscillation in the region of Landau absorption. In the second section the stochastic heating of the ions by plasma of different Langmuir turbulence was examined. The results showed that the tempo of heating of the ions differs from the tempo of the heating of electrons. In the third section the energy current of the plasma during instability of the Langmuir turbulence was examined. The general scheme of the energy balance of the plasma was examined under conditions where the Langmuir turbulence leads to modulation instability. (auth)

13922 (NP-20264) VOLUME AND SURFACE WAVES IN A THREE-DIMENSIONAL CONFINED PLASMA AND THEIR EXCITATION WITH RELATIVISTIC ELECTRON BEAMS. Aronov, B. A.; Bogdankevich, L. S.; Rukhadze, A. A. (AN SSSR, Moscow. Fizicheskij Inst.). 1974. 39p. (In Russian). Dep. NTIS (US Sales Only) $5.00.

Recent experimental and theoretical work on the excitation of waves in a confined plasma by relativistic electron beams is reviewed. The review is divided into three sections. In the first part, methods for the analysis of high-frequency electromagnetic oscillations in a three-dimensional confined plasma are discussed. The basic equations and their limiting conditions are formulated. In the second part, the results of theoretical studies of the excitation of electromagnetic waves by relativistic electron beams in a three-dimensional plasma are discussed. The conditions for the build-up of the oscillations and the corresponding increments are found. In the third section, the results of non-linear examination of the problem of the interaction of electron beams with plasma under conditions of one-mode instability are reported. The currents of electromagnetic radiation are calculated for these systems, and the efficiency of the conversion of the power of the electron current into radiation power was found. Theoretical results were compared with experimental values. (auth)

13923 (NP-20265) NONLINEAR DESCRIPTION OF THE QUASI-DECAY INTERACTION OF WAVES. Fal'k, L. F.; Tsytovich, V. N. (AN SSSR, Moscow. Fizicheskij Inst.). 1973. 40p. (In Russian). Dep. NTIS (US Sales Only) $5.00.

A theory of the quasi-decay interaction of the waves of a fixed

phase was constructed. Four-wave interaction and nonlinear displacement of the frequency was taken into consideration. Problems on the reverse scattering because of the quasi-decay and induced scattering of waves of the fixed phase were examined. A reflection coefficient close to 100% was obtained for induced scattering. The stabilization of the explosive instabilities of the quasi-decay processes was examined. Nonlinear quasi-decay equations of waves with zero energy were obtained and discussed. (auth)

13924 (NP-20266) MEASUREMENT OF THE REFLECTION COEFFICIENT OF POWERFUL PULSED uhf RADIATION FROM A NONSTEADY LOAD. Barinov, V. I.; Gekker, I. R.; Ivanov, V. A.; Karfidov, D. M. (AN SSSR, Moscow, Fizicheskij Inst.). 1974. 31p. (In Russian). Dep. NTIS (US Sales Only) $4.75.

The basic causes of error in the measurement of the reflection coefficient are classified into five groups. An attempt is made to evaluate the possible size of the error for each individual case and to verify the results experimentally. (auth)

13925 PROPOSED EXPERIMENTAL INVESTIGATION OF TRANSVERSE STRESS WAVE PROPAGATION IN PLASMAS AT MICROWAVE FREQUENCIES. Bydder, E. L.; Liley, B. S. (Univ. of Waikato, Hamilton, N. Z.). Aust. J. Phys.; 27: No. 3, 319-331 (Jun 1974).

The propagation properties of transverse electromagnetic waves in plasmas are discussed from the point of view of the 13-moment approximation. It is shown that additional modes, termed stress modes, should be able to propagate in a plasma even below the plasma frequency. The properties of these modes are examined, particularly with regard to energy transmission, and the conditions for their experimental detection are considered. Practical parameters for possible experiments are given. (auth)

13926 FORMATION OF NONLINEAR WAVE IN THE SYSTEM OF INTERACTING BEAMS OF POSITIVE AND NEGATIVE IONS. Gabovich, M. D.; Kozyrev, Yu. N.; Naida, A. P. (Inst. of Physics, Kiev). Ukr. Fiz. Zh. (Russ. Ed.); 19: No. 5, 860-861(May 1974). (In Russian).

The electrical field of nonlinear waves excited during the interaction of beams of positive and negative ions was measured directly. The appearance of high-amplitude cusped pulses on the wave profile was related to the formation of particle bunches in the beam and their capture by the wave field. (tr-auth)

13927 FINITE AMPLITUDE ION ACOUSTIC WAVES IN A PLASMON GAS. Sakai, J. I. (Nagoya Univ., Japan); Satsuma, J.; Yajima, N. J. Phys. Soc. Jap.; 36: No. 4, 1148-1157(Apr 1974).

The propagation of ion acoustic waves interacting with plasmon gas was investigated within an approximation, such that the rapid oscillations of electron plasma wave are averaged out; the equations for the slow mode of the ion acoustic wave are thus obtained. The decay interaction plays an important role in this process and leads to damping or growth of the ion acoustic wave depending on the shape of the plasmon energy spectrum. The result in the linear approximation is compared with that obtained by Vedenov and Rudakov to show incompleteness of their result. It is found that the finite-amplitude ion acoustic wave in plasmon gas obeys a Korteweg-de Vries equation modified by two additional terms, which represent change of the phase velocity and damping or growth of the amplitude. The decay rate so obtained is also compared with that of the electron Landau damping. (auth)

13928 INVESTIGATION OF THE INCREASE OF TRANSMISSIVITY OF THE WAVE BARRIER FOR ELECTRON PLASMA WAVES IN AN INHOMOGENEOUS PLASMA. Romanyuk, L. I.; Svavil'nii, N. E.; Ustalov, V. V. (Inst. of Nuclear Research, Kiev). Zh. Eksp. Teor. Fiz.; 67: No. 2, 579-585(Aug 1974). (In Russian).

The spatial characteristics of waves incident on a density barrier in an inhomogeneous collisionless plasma and "passing through" the barrier are investigated. It is shown that due to reflection of the excited wave from the barrier a standing wave is produced in the prebarrier plasma; in the plasma behind the barrier a rapidly damped traveling wave arises. Data are obtained on the dependence of the longitudinal wave vector component on frequency of the excited oscillations and plasma density. The type of wave modes is established. The experimental results are consistent with the concept of an increase of transmissivity of the wave barrier due to transfer of perturbation through it by particles captured by the wave in the prebarrier plasma. (auth)

13929 MACROSCOPIC PLASMA LAGRANGIAN AND ITS APPLICATION TO WAVE INTERACTIONS AND RESONANCES. Peng, Y. K. M. Stanford, CA; Stanford Univ. (1974). 264p. University Microfilms Order No. 74-27,081.

Thesis (Ph. D.).

A derivation is given of a macroscopic plasma Lagrangian, and its application to the description of non-linear three-wave interaction in a homogeneous plasma and linear resonance oscillations in an inhomogeneous plasma is discussed. One approach to obtain the Lagrangian is via the inverse problem of the calculus of variations for arbitrary first and second order quasi-linear partial differential systems. Necessary and sufficient conditions for the given equations to be Euler–Lagrange equations of a Lagrangian are obtained. These conditions are then used to determine the transformations that convert some classes of non-Euler–Lagrange equations to Euler–Lagrange equation form. The Lagrangians for a linear resistive transmission line and a linear warm collisional plasma are derived as examples. Using energy considerations, the correct macroscopic plasma Lagrangian is shown to differ from the velocity-integrated Low Lagrangian, by a macroscopic potential energy that equals twice the particle thermal kinetic energy plus the energy lost by heat conduction. The generalized variables are the macroscopic plasma cell position (Eulerian coordinates) defined in Lagrangian coordinates, and the vector and scalar potentials defined in Eulerian coordinates. With the continuity and heat flow equations treated as constraints, the Euler–Lagrange equations are shown to be the force law and Maxwell's equations. The effects of viscosity, heat conduction, and elastic collisions are included in this variational principle. The corresponding macroscopic Hamiltonian, and the microscopic Hamiltonian corresponding to the Low Lagrangian, are also derived. Under the assumptions of scalar pressure and adiabatic processes, the macroscopic Lagrangian is approximated by expansions in weak perturbations of the generalized variables. The averaged Lagrangian method is then used to derive non-linear three-wave coupling coefficients in a warm homogeneous two-component plasma. The effects of wave damping are included phenomenologically in the coupled mode equations. The general results are then specialized to make detailed quantitative comparisons between theory and available experimental results on parametrically excited ion-acoustic waves. The approximate quadratic Lagrangian is also used to estimate the electrostatic (Tonks–Dattner) resonance properties of an inhomogeneous plasma. The Rayleigh–Ritz procedure is applied directly to the Lagrangian corresponding to a system of Euler–Lagrange equations. Use of an appropriate set of trial functions then leads to frequency and eigenfunction estimates in excellent agreement with the existing theoretical and experimental results for a low pressure positive column. Since this method mainly involves evaluating finite integrals, and solving algebraic eigenvalue equations, it is found to be more efficient than numerically solving differential equations, and more accurate than inner–outer expansions. (Diss. Abstr. Int., B)

13930 RESONANCE CONE STRUCTURE IN A WARM ANISOTROPIC PLASMA. Burrell, K. H. Pasadena, CA: California Inst. of Tech. (1974). 164p. University Microfilms Order No. 74-27,150.

Thesis (Ph. D.).

A detailed theoretical and experimental investigation is given of the resonance cone pattern excited by a small antenna in a warm, magnetized plasma. The warm plasma theory is developed for an infinite, uniform plasma for arbitrary incident frequency $\omega < (\omega_{pe}^2 + \omega_{ce}^2)^{1/2}$ in the limit that $r/\lambda_{de} \gg 1$ and $r/r_{le} \gg 1$. Here, ω_{pe} and ω_{ce} are the electron plasma and cyclotron frequencies, respectively, while λ_{de} is the Debye length, r_{le} is the Larmor radius, and r is the distance from the source to the point of observation. The theory predicts the functional dependence of the angular position of the main resonance cone peak and the angular spacing between interference peaks on the physical parameters. The theory for plasmas with nonuniform density is also developed, but in the cold plasma limit, leading to predictions that the resonance cones can reflect off of density gradients. Experimental work verifying the theoretical picture is presented. The main cone angle is found to depend on ω, ω_{pe}, ω_{ce}, and r in a manner consistent with the theory, as is the angular interference spacing. The idea of resonance cones reflecting from density gradients can explain features of the data that are otherwise incomprehensible. From the data, values for ω_{pe} are obtained in two independent ways, and the results are consistent. The data also yield a value for the temperature that is appropriate for the afterglow plasma used in the experiment. Since both density and temperature can be obtained from the same data, resonance cone measurements are a useful diagnostic for plasmas in which antennas can be inserted. (Diss. Abstr. Int., B)

13931 EXCITATION OF ION OSCILLATIONS OF A PLASMA BY A FAST BEAM OF NEGATIVE IONS. Gabovich, M. D.; Simonenko, L. S.; Soloshnenko, I. A.; Shkorina, N. V. (Inst. of Physics, Kiev). Zh. Eksp. Teor. Fiz.; 67: No. 5, 1710-1716(Nov 1974). (In Russian).

Excitation of ion oscillations of a plasma by a beam of negative ions whose velocity considerably exceeds that of ion sound is discovered and investigated. The existence of conditions specific

for negative ions is established for which the electron Debye radius d_e considerably exceeds the beam radius or plasma radius r_0 and for which the effect of electrons on oblique perturbations may be neglected for arbitrary value of the perturbation frequency. Calculations performed for such conditions show that a standing wave along the radius should exist whose radial structure depends only on the initial condition. It is also shown that in the opposite case ($d_e \ll r_0$) ion oscillations moving in the transverse direction should be excited whose dispersion corresponds to the theory of an infinite plasma. (auth)

13932 EVOLUTION OF NONLINEAR LANGMUIR WAVES IN WEAKLY INHOMOGENEOUS PLASMAS. Istomin, Ya. N.; Karpman, V. I. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-wave Propagation, Moscow). Zh. Eksp. Teor. Fiz.; 67: No. 5, 1693-1701(Nov 1974). (In Russian).

An expression for the amplitude and phase of a nonlinear electrostatic wave in an inhomogeneous plasma is obtained from which it follows that even a small concentration gradient significantly alters the dependence of the amplitude and phase on distance from the source (as compared to that for a homogeneous plasma). Moreover, the additional phase shift due to inhomogeneity of the plasma increases and in some cases determines the modulation instability increment. An experimental test of the results is feasible. (auth)

13933 SCATTERING OF TE- AND TM-WAVES ON BOUNDED ISOTROPIC MEDIA IN A WAVEGUIDE. Urazakov, E. I. Vestn. Mosk. Univ., Ser. III. Fiz. Astron.; 15: No. 4, 386-394(1974). (In Russian).

A solution to the problem of the scattering of an arbitrary waveguide wave (of the TE- or TM-type) on an isotropic bounded medium is presented. Equations and scattering coefficients are obtained connecting the amplitude of the incident wave with the electrical characteristics of the medium. The inhomogeneity of the medium is considered. (SJR)

13934 NONLINEAR PLASMA THEORY. Galeev, A. A.; Sagdeev, R. Z. Vop. Teor. Plazmy; No. 7, 3-145(1973). (In Russian).

A survey is presented of plasma phenomena resulting from nonlinearities in the system. Nonlinear plasma interactions are discussed from the point of view of the weak turbulence theory. Some material relating to strong turbulence effects is also presented. Subjects are wave-wave interactions, resonant interaction of plasma waves, finite-amplitude waves, higher-order parametric instabilities, weak turbulence and the kinetic equation for waves, approximations of geometrical optics and of adiabatic theory; wave-particle interactions, monochromatic-wave case, the many-wave case, effects of collisions, the quasi-linear theory of modes, drift instabilities; nonlinear wave-particle interactions, Langmuir turbulence, ion-acoustic turbulence, induced scattering of light, radiation-line relaxation; anomalous resistance in a plasma, conservation laws, and others. (IAA)

13935 WAVE PROCESSES IN AN INHOMOGENEOUS PLASMA. Erokhin, N. S.; Moiseev, S. S. Vop. Teor. Plazmy; No. 7, 146-204 (1973). (In Russian).

A survey is made of recent work on linear and kinetic phenomena in nonhomogeneous plasmas. The discussion of linear wave propagation includes a full treatment of the intersection of solutions and of the effect of nonequilibrium in the medium as well as multiple inhomogeneities. Partial contents are the linear transformation of waves in an inhomogeneous plasma, types of intersecting solutions, subbarrier transformation, anomalous transformation of waves, properties of wave transformations and transient radiations in plasmas with charge-beam interactions, channeling and absorption at points of field singularity; generation of harmonics, decay processes, radiation spectra, the case of nonlinear wave interaction, spectra of trapped radiations, passage of radiation through a wave barrier in an inhomogeneous plasma, nonlocal effects, magnetic breakdown, and others. (IAA)

ENGINEERING

Energy Conversion

13936 (GESP-7097(Pt. 1)) MULTI-HUNDRED WATT RADIOISOTOPE THERMOELECTRIC GENERATOR PROGRAM. Part I. Annual Report, 1 July 1971–31 December 1972. (General Electric Co., Philadelphia, Pa. (USA). Space Div.). 1972. Contract AT(29-2)-2831. 484p. Dep. NTIS $27.25.

The fuel sphere impact test program and related analytical studies were conducted to evaluate the many variables and arrive at the final design configuration. Among the many parameters examined were graphite densities, resin impregnation, shell construction, winding layups, clad materials, products of different vendors, fuel simulants, single and multiple sphere effects, sphere eccentricity, test equipment and test procedures. Other analytical and empirical work was directed toward fuel form selection, iridium joint design, fuel/liner clearances, thermal loadings, gas management (particulate filter design), multiple skip reentry, unicouple loadings, and other variables. Iridium characterization and studies of its compatibility with PPO, PMC, SiGe and other materials were continued. A number of 4-couple, 6-couple and larger test modules were built and vibrated to evaluate selected design parameters and MHW-RTG prototype components under dynamic environments. The first graphite dynamic electric heat source was assembled, verification tested and installed in a test converter (TBC No. 3). Testing of the first full-scale Test Bed Converter (TBC-1) was started. Initial performance was better than predicted, but the test had to be aborted because of electric heater instability. Tear-down analysis revealed deterioration of the tungsten heater which was replaced with a graphite heater when the converter was reassembled, and testing resumed. A total 2900 h of test time were accumulated on TBC No. 1, after which the unit was shipped to JPL for life testing. The second full-scale converter (TBC-3) was designed, built, processed and subjected to vibration, shock, acoustic and performance testing. Design configuration was established for the third full scale converter (TBC-4), which will be the first to receive a fueled isotope heat source. Hardware procurement and initial assembly work was started on this unit. The Safety Test Program Plan was revised to be in concert with the requirements of the environments established for the LES 8/9 mission. The Preliminary Safety Analysis Report and a number of individual safety test plans were prepared, submitted for AEC approval, and issued. Orders were placed for long-lead materials and piece parts required for assembly and test of the qualification (Q-1) and flight (F1 through F5) units and for two engineering models (E1 and E2). Design was initiated for a number of GSE items, including the RTG and Converter shipping containers, test consoles, IHS storage protection container, RTG loading and assembly station, and several handling slings, tools and fixtures. This abstract also covers Part II of this report. (auth)

13937 (GESP-7097(Pt. 2)) MULTI-HUNDRED WATT RADIOISOTOPE THERMOELECTRIC GENERATOR PROGRAM. Part II. Annual Report, 1 July 1971–31 December 1972. (General Electric Co., Philadelphia, Pa. (USA). Space Div.). 1972. Contract AT(29-2)-2831. 332p. Dep. NTIS $19.75.

The abstract for Part I of this report also covers the material in Part II. (TFD)

13938 (TID–26706) MULTI-HUNDRED WATT RADIOISOTOPE THERMOELECTRIC GENERATOR PROGRAM. Bi-Monthly Progress Report, 1 March–30 April 1974. (General Electric Co., Philadelphia, Pa. (USA). Space Div.). 1974. Contract AT(29-2)-2831. 173p. Dep. NTIS $11.75.

Research progress is reported under the following topics: program management; safety; systems; isotope heat source; converter; product assurance; acceptance testing; qualification testing; ground support equipment; thermal simulators; and ORNL outer clad fabrication. (TFD)

13939 (TID–26707) MULTI-HUNDRED WATT RADIOISOTOPE THERMOELECTRIC GENERATOR PROGRAM. Bi-Monthly Progress Report, 1 May–30 June 1974. (General Electric Co., Philadelphia, Pa. (USA). Space Div.). 1974. Contract AT(29-2)-2831. 121p. Dep. NTIS $9.25.

Research progress is reported under the following topics: program management; safety; systems; isotope heat source; converter; product assurance; converter fabrication; acceptance testing; qualification testing; ground support equipment; and ORNL outer clad fabrication. (TFD)

13940 (TID–26708) MULTI-HUNDRED WATT RADIOISOTOPE THERMOELECTRIC GENERATOR PROGRAM. Bi-Monthly Progress Report, 1 July–31 August 1974. (General Electric Co., Philadelphia, Pa. (USA). Space Div.). 1974. Contract AT(29-2)-2831. 135p. Dep. NTIS $9.75.

Research progress is reported under the following topics: program management; safety; systems; isotope heat source; converter; product assurance; converter fabrication; acceptance testing; qualification testing; ground support equipment; and ORNL outer clad fabrication. (TFD)

Facilities and Equipment

13941 (SAND-74-5400) PREDESIGN ANALYSIS TECHNIQUE FOR REINFORCED CONCRETE STRUCTURES. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 30p. (CONF-740949-1). Dep. NTIS $4.50.

From 16th Dept. of Defense Explosives Safety Board Seminar; Miami, Florida, USA (24 Sep 1974).

A computer program is presented for performing a predesign analysis of a test cell in which pressure vessels can be destructively tested using high explosives. (TFD)

13942 (WANL-TME–1272) OPERATIONAL MANUAL AND ACCEPTANCE TEST PROCEDURES FOR ETS-1 AVERAGE AND REJECT CHASSIS (LOG NUCLEAR INSTRUMENTATION). Model 938J166G01. Hardies, C. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1966. 69p. Dep. NTIS $6.50.

This operational manual contains the general description, theories of operation, alignment procedures, maintenance and repair data, and interconnection diagrams for the WANL NRX Average and Reject Chassis. The Average and Reject Chassis is a rack mounted, wholly self-contained, all solid state electronic averaging and rejection circuit. It is a card rack assembly mounted in a chassis drawer. The instrument electronically averages the input signals, automatically rejects any input outside of an adjustable "reject" band from this average and provides an output signal equal to the average of the inputs not rejected and an output signal proportional to the period (rate of change) of the average signal. The instrument has provision for manually rejecting inputs and inhibiting the automatic rejection of channels. Redundancy in the averaging system insures that a single instrument failure will not result in loss of the output average signal. (auth)

13943 (WANL-TME–1284) NRX AVERAGE AND REJECT CHASSIS OPERATIONAL MANUAL. Log Nuclear Instrumentation. Hardies, C. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 30 Sep 1965. 54p. Dep. NTIS $5.75.

This operational manual contains the general description, theories of operation, alignment procedures, maintenance and repair data, and interconnection diagrams for the WANL ETS-1 Average and Reject Chassis for the Log Nuclear Instrumentation system. The Average and Reject Chassis is a rack mounted, wholly self-contained, all solid state electronic averaging and rejection circuit. It is a card rack assembly mounted in a chassis drawer. The instrument electronically averages the input signals, automatically rejects any input outside of an adjustable "reject" band from this average and provides an output signal equal to the average of the inputs not rejected and an output signal proportional to the period (rate of change) of the average signal. The instrument has provision for manually rejecting inputs and inhibiting the automatic rejection of channels. Redundancy in the averaging system insures that a single instrument failure will not result in loss of the output average signal. (auth)

13944 (WANL-TME–1850) MULTIAXIAL STRESS AND FRACTURE. Manjoine, M. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1 Sep 1968. 75p. Dep. NTIS $6.75.

Three phases of the fracture process are (1) accumulation of damage at an origin, (2) initiation of a crack surface, and (3) propagation. The accumulation of damage at an origin is a microscopic phase associated with the atomic, crystal lattice or grain boundary properties of a material and the loading history. When the local strength or ductility is exceeded, a crack surface is formed. With continued or continual loading history, the crack surface or surfaces propagate across the cross section to fracture. The local strength is the capacity of the molecules to cling together. Duc-

tility is the ability of the microstructure to deform and relieve peak forces that are tending to overcome the local strength. Both of these properties, strength and ductility, are influenced by the state of stress, as well as, by strain rate, temperature, metallurgical state, environment and their histories. Thus, these properties may exhibit a different behavior or character in each phase of fracture. Also a homogeneous material on a macroscale may be highly anisotropic on a microscale. Attention is primarily focused on the influence of state of stress on the strength and ductility of a material. The state of stress is defined by the three-dimensional distribution of normal and shear forces at a point or by the three principal stresses and their directions. This multiaxial stress can be produced by external multiaxial loading, by geometry of the structure or microstructure under any loading, by thermal distortions, or by microstructural volume changes. (auth)

13945 NOVEL PARTICLE-SIZING TECHNIQUE FOR HEALTH PHYSICS APPLICATIONS. Waite, D. A.; Nees, W. L. (Battelle Pacific Northwest Labs., Richland, WA). pp 197-203 of Environmental Surveillance Around Nuclear Installations. Vol. II. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol.2); CONF-731117-(P2).

A new concept in the sizing of radioactive or non-radioactive airborne particulate matter has been assembled into a mobile field unit and is being used to obtain environmental and health physics particle-size information. The glow-discharge perturbation method economically generates particle-size data which can be directly accumulated and spectrometrically analyzed by a multichannel analyser. The basics of the glow-discharge technique are touched upon and compared to other instrumentation presently available in this province of the environmental sciences. The physical description, operational characteristics, and current uses of the apparatus are detailed, together with important design and operational parameters. Particle-size distribution data and analysis techniques illustrating the utility of this system are presented. The potential contributions to environmental surveillance of this approach appear to be many. Anticipated influences on the estimation of individual and/or population dose from airborne particulate matter and on the evolution of basic objectives of environmental surveillance programmes are discussed. Applicability of this approach to some difficult problems in environmental data interpretation and utilization are assessed. Noteworthy among these are: (1) the partition of responsibility for population radiation exposure among local contributors of airborne particulate matter, where differentiation by isotopic spectrographic means is difficult or impossible; (2) the estimation of soil re-suspension importance to regional population lung exposures; and (3) the economical provision of data usable for increasing the utilization of lung models in calculating population exposure. Suggestions for future application of this method to research studies in support of environmental surveillance are given. Included are particle sizing of deposited particulate matter, determinations of effluent properties, and sampling characteristics of field instrumentation. (auth)

Lasers

Refer also to abstract 14693.

13946 (AD-781438) NONSELF-SUSTAINED STATIONARY GAS DISCHARGE IN N_2-CO_2 MIXTURES AT AN ATMOSPHERIC PRESSURE AND IONIZATION BY AN ELECTRON BEAM. Velikhom, E. P.; Golubev, S. A.; Zemtsov, Yu. K.; Pal, A. F.; Persiyantsev, I. G. Translated from Zh. Eksp. Teor. Fiz.; 65: No. 2, vp(1973). 10p. (NISC-TRANS-3548). NTIS $4.00.

An investigation of an induced gas discharge in N_2-CO_2 mixtures under atmospheric pressure is reported. A beam of electrons with an energy of about 100 keV and a current of about 50 microampere is used as an external ionizer. A stable burning of such a discharge under stationary conditions was achieved in this experiment. Subsequent analysis indicates possible use in the future of such discharges for a combined pumping of CO_2 lasers. (GRA)

13947 (AD-781445) EXPERIMENTAL INVESTIGATIONS OF THE LIGHT AMPLIFICATION FACTOR IN $CO_2 + N_2 + He$ (H_2O) MIXTURES DURING EXPANSION IN A SUPERSONIC NOZZLE. Gembarzhevskii, G. V.; Generalov, N. A.; Kozlov, G. I. Translated from Zh. Prikl. Mekh. Tekh. Fiz.; No. 4, 18-24(1973). 14p. (NISC-TRANS-3544). NTIS $4.00.

In the present investigation the light amplification factor of a mixture of 10% CO_2 + 40% N_2 + 50% He was measured during supersonic expansion over a wide range of variation of experimental conditions: total temperature T = 800 to 3600°K, and gas pressure P = 2.5 to 40 atm, where the relative nozzle cross-section assumed several fixed values $S/S^* = 18.2, 36.2, 49$, and 59, where S^* is the critical nozzle cross-section, and S is the cross-section in the measurement zone. A mixture of 10% CO_2 + (90 − X)% N_2 + X% H_2O (where X = 0 to 5%) was investigated in the total temperature range of T = 800 to 2200°K and total pressure range of P = 1.5 to 40 atm with relative nozzle cross-section of $S/S^* = 18.2, 36.2$, and 59. The data obtained for the amplification factor are compared with values which were calculated by a previously proposed method. (GRA)

13948 (AD-781632) NONSELF-SUSTAINED STATIONARY GAS DISCHARGE IN N_2-CO_2 MIXTURES IONIZED BY AN ELECTRON BEAM AT ATMOSPHERIC PRESSURE. Velikhov, E. P.; Golubev, S. A.; Zemtsov, Yu. K.; Pal, A. F.; Persiantsev, I. G. Translated by V. Mesenzeff feom Zh. Eksp. Teor. Fiz.; 65: No. 2, 543-549(Apr 1973). 17p. (FTD-HT-23-1979-74). NTIS $3.00.

A nonself-sustained gas discharge in N_2-CO_2 mixtures at atmospheric pressure was made. An electron beam was used as the external ionizer. In the experiment, stable burning of such a discharge in a steady-state regime was realized. This analysis shows promise in the use of such discharges for combined pumping of CO_2 lasers. (GRA)

13949 (AD-781785) TRANSIENT POPULATIONS OF EXCITED STATES OF N_2 UNDER PULSED DISCHARGE CONDITIONS. Cartwright, D. C.; Fiamengo, N. A. (Aerospace Corp., El Segundo, Calif. (USA)). 19 Jun 1974. Contract F04701-73-C-0074. 8p. (SAMSO-TR-74-145). NTIS. $3.00.

The transient populations of three singlet and seven triplet excited electronic states of N_2 were examined theoretically for pulsed discharge conditions. The singlet N_2 laser processes were interpreted, and the possibility of new laser lines examined. (auth)

13950 (AD-783290) CALCULATION OF TURBULENT SHEAR FLOWS IN LASER NOZZLES AND CAVITIES. Varma, A. K.; Donaldson, C.; Fishburne, E. Stokes. (Aeronautical Research Associates of Princeton, Inc., N. J. (USA)). Feb 1974. 22p. (AFOSR-TR-74-1252). NTIS $3.00.

Considerable insight into the complex processes occurring in laser cavities has been achieved through the use of a simple, single species invariant second-order closure model of the turbulent flow equations. However, this present program cannot consider the effects of the highly exothermic chemical reaction involved in an hf chemical laser. Substantial progress has already been made towards the development of the multi-component reacting program and this effort is continuing. (auth)

13951 (NTIS-WIN-74-046) CARBON DIOXIDE LASERS. A Bibliography with Abstracts. Report for May 1964-May 1974. Craig, D. M. (National Technical Information Service, Springfield, Va. (USA)). Jun 1974. 175p. (COM-74-11056). NTIS $20.00.

The bibliography contains 170 selected abstracts of research reports retrieved using the NTIS on-line search system-NTISEARCH. The design, construction, operation, and performance of CO_2 lasers are included. Other topics include excitation, optical pumping, light pulses, infrared windows and optical materials, mirrors, frequency tuning and modulation, chemical reactions, and gas dynamics. Foreign translations and reports not available through NTIS are excluded. (GRA)

13952 (SAND-74-0147) MULTIPLE CAVITY LASER SYSTEM. Landry, M. J.; McCarthy, A. E. (Sandia Labs., Albuquerque, N. Mex. (USA)). Dec 1974. Contract AT(29-1)-789. 21p. Dep. NTIS $4.25.

A four pulse multiple cavity laser (MCL) system has been developed for use in recording time sequential holograms of fast events. The MCL system emits 25 to 40 ns laser pulses with time spacing between pulses of from 25 ns to 1.25 ms. The lasers in the MCL system were operated in their saturation mode with ≈70 to 80 mJ of output energy. Each laser output was in the TEM_{00} mode with ≈2.0 mrad beam divergence and >15 cm coherent length at these energy levels. (auth)

13953 TRANSVERSELY EXCITED HIGH PRESSURE CARBON-DIOXIDE LASER. Patel, B. S. (Solid State Physics Lab., Delhi). Proc. Indian Nat. Sci. Acad., Part A; 39: No. 5, 309-313(Sep 1973).

With the development of transversely excited atmospheric (TEA) carbon-dioxide lasers in 1970, it is possible to obtain short laser pulses in the megawatt peak power range from a modest length of the laser. At high pressures, the linewidth of the laser transition is dominantly collision-broadened and hence a large linewidth is available at atmospheric pressure. Increased gain-band-width product in the TEA lasers provide large inversion density and

hence large optical energy. A high pressure carbon-dioxide laser was constructed. It employs a continuously running gas mixture of CO_2, N_2, and He up to a total pressure of about 100 torr. The laser is excited by 18 kV electrical pulses of about 1.0 μsec duration and about 1000 amperes peak current. Laser pulses are produced in the gain-switched regime whereby about 100 kW peak power pulses of about 0.5 μsec duration are produced. The laser output has been detected by a fast photon drag detector whose rise-time is in the sub-nanosecond range. The detector was also fabricated in the laboratory. (auth)

13954 NEW CW LASER OSCILLATION IN He–Zn HOLLOW CATHODE LASER. Iijima, T.; Sugawara, Y. (Seikei Univ., Tokyo). J. Appl. Phys.; 45: No. 11, 5091-5092(Nov 1974).

A new cw laser line in ZnII was observed using an improved hollow cathode laser tube. The wavelength and the transition assignment are 7732.5 Å and $5p^2P^0_{\frac{1}{2}} - 5s^2S_{\frac{1}{2}}$, respectively. The new laser line and the strong laser line at 7588 Å have a common lower laser level $5s^2S_{\frac{1}{2}}$, and the anode temperature (metal vapor pressure) dependence of the threshold current of these two laser lines showed a similar tendency. (auth)

13955 FARADAY ROTATION OPTICAL ISOLATOR FOR 10.6-μm RADIATION. Jacobs, S. D. (Inst. of Optics, Rochester, NY); Teegarden, K. J.; Ahrenkiel, R. K. Appl. Opt.; 13: No. 10, 2313-2316(Oct 1974).

Measurements that have been performed indicate that hot-pressed ferromagnetic $CdCr_2S_4$ would be a useful Faraday optical isolator material for laser systems at 10.6 μm. A large-aperture, liquid-nitrogen-cooled isolator, requiring modest magnetic fields with material of optimum thickness, would provide isolation in excess of 30 dB with insertion loss due to optical absorption in the active element of less than 3 dB. Consideration of its figure of merit indicates that hot-pressed $CdCr_2S_4$ could be used as an isolator at 1.06 μm, introducing less than 2 dB insertion loss due to optical absorption at that wavelength. (auth)

13956 TRANSFER CHEMICAL LASER DELIVERS 13% EFFICIENCY. Davis, R. T. Microwaves; 13: No. 1, 14(Jan 1974).

A ten liter transfer chemical laser, based on the reaction of D_2, F_2, and CO_2, was developed which provides an overall efficiency of 13%. Xenon flash lamps initiate the reaction to produce excited DF, the energy of which is then transferred to the CO_2 to produce 205 J of laser energy at 10.6 μ. Smaller versions of this type laser have been in development for some time with up to 1.2% efficiency. However, this is the first such device to operate at an efficiency competitive with electrically pumped CO_2 lasers. The ten liter volume and 200 J output energy are about 40 times larger than previous devices. The secret of the increased efficiency is the design of the laser reaction chamber. By increasing the transverse dimensions of the laser chamber and coating all wall surfaces with a highly reflective material, the ultra-violet photon loss to the reaction medium is enhanced relative to wall losses. (TFD)

13957 SIMPLE CIRCUIT TRIGGERS LASERS. Jensen, O. Microwaves; 13: No. 1, 54; 56(Jan 1974).

Designers often need high-voltage waveforms at high repetition rates, such as for laser triggering. The "trick" is to select combinations of devices and techniques to yield the desired performance. A schematic of a combination of devices that can be used to generate a 4 kV laser triggering waveform at a repetition rate between 10 and 12 kHz is presented. To generate the high-voltage pulse required to ignite a gas laser a capacitor can be discharged through a transformer primary circuit. Basically, the circuit consists of a step-up transformer and an R-C charging network. (TFD)

13958 THEORY OF A GIANT-PULSE LASER MODULATED BY ACTIVE AND PASSIVE Q-SWITCHES SIMULTANEOUSLY. Huang, H. C. (Academia Sinica, Peking). Sci. Sinica (Peking); 17: 363-391(Jun 1974).

Theory of a doubly Q-switched giant pulse laser is set forth with the inclusion of a time-dependent switching function and saturable absorber terms in the rate equations. Three regions of operation are distinguished: (1) the single-pulse region in which one giant pulse occurs; (2) the multiple-pulse region, in which one or more pulses follow the initial giant pulse; and (3) the cut-off region, which prohibits generation of any pulse. The conditions for these three regions of operation are given explicit mathematical form. Curves are drawn for typical system parameters which indicate range of values of motor speed and dye concentration for the regions of operation. It is shown that, at the start of stimulated emission, the passive Q-switch plays a predominant role in restricting the switching angle of the doubly Q-switched system. In the later period of giant-pulse formation, it seems that only the active switch (spinning mirror) is functioning, and the dye cell, which is being bleached in this period, can be considered as almost nonexistent. Computer computational results are presented in order to test the validity of the approximations made in the theory. (IAA)

13959 MEASUREMENT OF THE PHASE FLUCTUATIONS IN A He–Ne ZEEMAN LASER. Owens, D. K.; Weiss, R. (Massachusetts Inst. of Tech., Cambridge). Rev. Sci. Instrum.; 45: No. 9, 1060-1062(Sep 1974).

The measurement of the phase fluctuations caused by spontaneous emission in the oscillation of a He–Ne laser operating at 1.15 μ is reported. The frequency fluctuations in the signal resulting from heterodyning two independent modes in the laser were measured as $f^2(\nu) = (9.6 \pm 2) \times 10^{-2}$ Hz²/Hz for 1.65×10^7 stored photons per mode and $f^2(\nu) = (2.7 \pm 0.3) \times 10^{-1}$ Hz²/Hz for 6.2×10^6 stored photons per mode. These values are to be compared with the theoretical minima for these cases, which are calculated to be $f^2(\nu) = 5.1 \times 10^{-2}$ Hz²/Hz and $f^2(\nu) = 1.4 \times 10^{-1}$ Hz²/Hz, respectively. (auth)

13960 OBSERVATION OF LAMB DIP FOR AN HF CHEMICAL LASER. Bonczyk, P. A. (United Aircraft Research Labs., East Hartford, CT). J. Appl. Phys.; 45: No. 11, 5077-5078 (Nov 1974).

Lamb dips are observed for $\nu = 1-0$, P(4)–P(10) and $\nu = 2-1$, P(4)–P(8) HF laser lines. The dip shape is strongly dependent upon molecular rotation. (auth)

13961 THEORY OF A GIANT-PULSE LASER MODULATED BY ACTIVE AND PASSIVE Q-SWITCHES SIMULTANEOUSLY. Huang, H. C. Sci. Sinica (Peking); 17: No. 3, 363-391(Jun 1974). (In Chinese).

A theory of doubly Q-switched giant pulse lasers by the inclusion of a time-dependent switching function, as well as a saturable absorber term, in the rate equations is presented. A self-consistent analysis of the composite system is made. Solutions to a number of problems believed to be interesting and important from a practical point of view are attempted. There exists three regions of operation: (1) the single-pulse region in which single-pulse output is ensured; (2) the multiple-pulse region in which a second or more pulses may follow; and (3) the cut-off region which prohibits the occurrence of any pulse. Expressions are derived and curves drawn for typical system parameters, which indicate the range of values of the motion speed and dye concentration for different regions. For single-pulse operation, three different modes may be further defined. The efficient mode is one which delivers maximum power for arbitrary output-mirror transmissivity. The optimum mode delivers still higher power with the transmissivity selected at the optimum value. The ordinary mode refers to operation in single-pulse but not with maximum power. Orders of magnitude of the system parameters that are required to achieve the efficient or optimum mode are estimated. The theory applies, as it should, to a laser singly Q-modulated either by an active or by a passive switch, which are two special cases of the general scheme considered herein (one with zero dye-concentration, the other, with zero motor-speed. The theory is based on analytic method. Computer results included in the Appendix serve as a check of the accuracy of the analytic method, which inevitably involves a number of approximations. (JPRS)

13962 PROBLEM OF SUPERREGENERATIVE AMPLIFICATION OF COHERENT OPTICAL RADIATION FROM GAS LASERS. Kulakov, B. P.; Nurmukhametov, V. K. Tr. Univ. Druzhby Nar.; 62: 93-98(1972). (In Russian).

The kinetic equations describing a gas laser with heterogeneous broadening of the amplification lines in superregenerative strengthening of an external signal are numerically solved. It is shown that the use of modulating the laser Q by pulses with a duration of 3 to 4 μsec permits attaining a power amplification of the order of 10^8 for a weak signal. Evaluations are made for a He–Ne laser (1.15 microns, a 100-cm resonator, a mirror reflection coefficient of 0.98). The amplifier has a high transit time (of the order of microseconds) determined by the high Q of the resonator. (Referativnyi Zh.)

13963 AMPLIFICATION OF ELECTROMAGNETIC RADIATION BY SHOCK EXCITATION OF TRANSIENT PHENOMENA IN AN ACTIVE RESONATOR. Kulakov, B. P.; Nurmukhametov, V. K. Tr. Univ. Druzhby Nar.; 62: 84-88(1972). (In Russian).

A new type of laser amplifier, with shock excitation of the active resonator amplified by radiation, is proposed. The gain is evaluated and the shape of the amplifier output signal is calculated under the condition that at the frequencies of the spectrum of a signal different from the particular resonator frequencies, the amplification in one channel exceed unity with all losses taken into account. It is shown that through the use of the pro-

posed amplifier there is no need for rigid stabilization of the signal frequency and the resonator length. It is suggested that this amplifier is especially effective for small amplification factors or active medium lengths. (Referativnyi Zh.)

13964 CN PHOTODISSOCIATION AND PREDISSOCIATION CHEMICAL LASERS: MOLECULAR ELECTRONIC AND VIBRATIONAL LASER EMISSIONS. West, G. A.; Berry, M. J. (Univ. of Wisconsin, Madison). J. Chem. Phys.; 61: No. 11, 4700-4716(1 Dec 1974).

Molecular electronic [$CN^*(A^2\Pi_i, v' = 0) \rightarrow CN(X^2\Sigma^+, v' = 0, 1, 2)$] and vibrational [$CN^\dagger(X^2\Sigma^+, v') \rightarrow CN(X^2\Sigma^+, v' - 1), v' = 5, 4, 3, 2$] cyanide radical laser emissions have been observed following photodissociative and predissociative fragmentation of cyanide parents [HCN, ClCN, BrCN, ICN, $(CN)_2$, CH_3NC, CF_3CN, C_2F_5CN] at $\lambda \geq 1550$ Å. The observed transitions and their relative gain coefficients and quenching behaviors are used in connection with spectroscopy and fluorescence experiments to formulate a state-to-state photochemical reaction mechanism in which nascent photochemical products are formed with high electronic population inversion [$N_{CN^*(A)}/N_{CN(X)} \gg 1$] and no vibronic inversion within the $A^2\Pi_i$ manifolds (i.e., $v = 0$ is the principal product vibronic state). Near-resonant collision-induced intersystem crossing is shown to preferentially populate $v = 4$ within the $X^2\Sigma^+$ electronic manifold. Electronic and vibronic population inversions are treated via state-to-state adiabatic correlation diagrams and a simple dynamical model for reaction product vibronic state distributions. Anomalous laser behavior in the BrCN photodissociation system is rationalized via an intramolecular near-resonant $E \rightarrow E'$ energy transfer scheme. (auth)

13965 RELAXATION-TIME MEASUREMENT OF CO_2 LASER BY Q-SWITCHING TECHNIQUE. Kitazima, I. (Fukui Univ., Japan). J. Appl. Phys.; 45: No. 11, 4961-4963(Nov 1974).

The present paper proposes that one can easily observe either the relaxation time of the 10^00 level or that of the 01^10 level in a CO_2 laser system under cw excitation by use of rotating-mirror Q-switching techniques. It is mentioned here that the optimum repetition time T_{ropt} for the laser pulse height corresponds to the relaxation time of the 01^10 level (τ_{010}) and the cutoff pulse interval T_{roff} for the second pulse corresponds to the relaxation time of the 10^00 level (τ_{100}). When the CO_2 (1.8 torr)-He (7.2 torr) mixture was sealed in a water-cooled Pyrex tube 20 mm in inside diameter and 170 cm in length, T_{ropt} was measured to be 7 msec and T_{roff} was 40 μsec, at a discharge current of 15 mA. These values were in satisfactory agreement with the values of τ_{010} and τ_{100} previously obtained by pulse-excitation techniques. (auth)

13966 WAVELENGTH MEASUREMENTS OF SIMULTANEOUSLY EXCITED SUPERRADIANCE AND LASER EMISSION FROM CRYPTOCYANINE DYE. Sugiura, Y.; Matsunaga, Y.; Fujioka, T. (Keio Univ., Yokohama, Japan). J. Appl. Phys.; 45: No. 11, 4969-4970(Nov 1974).

The wavelengths of both superradiance and laser emission simultaneously excited from cryptocyanine were measured as functions of cell length and angle between the two beams. (auth)

13967 PARTIALLY HOMOGENEOUSLY BROADENED GAS LASER AMPLIFIERS: MODELLING AND EXPERIMENTAL APPLICATIONS. Ostrem, J. S. Irvine, CA; Univ. of California (1974). 345p. University Microfilms Order No. 74-29,043.

Thesis (Ph. D.).

With the ever-increasing interest in the application of lasers and laser amplifiers for communication, scientific, and industrial purposes, it is necessary that we better understand the operating characteristics of lasers and laser amplifiers. Parameters of particular interest in the modelling and design of gas lasers are the Doppler linewidth, Lorentzian linewidth, spontaneous emission linewidth, gain, population inversion, and saturation intensity. A knowledge of these parameters is important in predicting and understanding such laser amplifier characteristics as power output, saturation behavior, line-narrowing, dispersion, pulse propagation, and others. (Diss. Abstr. Int., B)

13968 SELF FOCUSING IN LASER MATERIALS. Suydam, B. R. (Los Alamos Scientific Lab., NM). pp 34-42 of Optoelectronics and Laser Technology. New York; Inst. of Electrical and Electronics Engineers, Inc. (1974).

From 6th conference on optoelectronics and laser technology; Albuquerque, NM (24 Apr 1974).

A review of the theory of self-focusing in laser materials, with special attention to the role of self-focusing in limiting peak laser output intensity is presented. In particular, the problem of determining the self-focal length from given laser beam and material parameters is considered. Though no satisfactory theory of self-focusing is as yet in existence, it is shown that this problem is amenable to reliable solutions over the whole range of beam intensities of interest, provided the initial beam contour is smooth. The determination of the self-focal length is made possible through appropriate use of two incomplete theories, one describing the total collapse of a beam to a single point focus, and the other describing the unstable break-up of a beam into a myriad of self-foci. (IAA)

Cryogenic and Superconducting Equipment and Devices

Refer also to abstracts 14731, 15286, and 15292.

13969 (BNL-19272) MAGNETIZATION AND DESIGN OF MULTISTRAND SUPERCONDUCTING CONDUCTORS. Walters, C. R. (Brookhaven National Lab., Upton, N. Y. (USA)). 30 Sep 1974. 8p. (CONF-740957-25). Dep. NTIS $4.00.

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974).

Magnetization of cabled and braided samples which are long compared to their transposition lengths has been measured in a uniform magnetizing field directed at right angles to their widths. A separated double pancake with nonuniform windings was constructed to produce a suitably uniform radial field in which long coiled samples could be placed. Magnetization losses have also been measured in the ISA I magnet at BNL. Results are compared with theories which are due to Wilson and, basically, Morgan. Also, design optimization procedures have been defined for the use of multistrand conductors in magnet windings. (auth)

13970 (BNL-19283) SELF-SYNCHRONOUS PARAMETRIC AMPLIFICATION USING JOSEPHSON JUNCTIONS. Yu, M. L. (Brookhaven National Lab., Upton, N. Y. (USA)). 30 Sep 1974. 3p. (CONF-740957-26). Dep. NTIS $4.00.

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974).

A new way to use Josephson junctions for parametric amplification with phase control is proposed. The dc current bias of the junction is adjusted such that the Josephson oscillation automatically synchronizes with the input signal and oscillates at twice the signal frequency with the proper relative phase. The impedance of the junction then has a negative resistive component which can be used for amplification. Extension to other phase sensitive circuits is also discussed. (auth)

13971 (BNL-19284) COHERENT AC JOSEPHSON EFFECT IN A BULK GRANULAR SUPERCONDUCTING SYSTEM. Yu, M. L.; Saxena, A. M. (Brookhaven National Lab., Upton, N. Y. (USA)). 30 Sep 1974. 4p. (CONF-740957-27). Dep. NTIS $4.00.

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974).

A three-dimensional close-packed array of Josephson junctions was successfully produced in the form of a bulk granular superconductor. The granular system is a tightly compressed solid of oxide coated small tin particles in the thousand Å range. The three-dimensional array of Josephson junctions thus formed showed coherent Josephson oscillations when external rf radiation was imposed. rf induced constant voltage steps were observed on its I-V characteristics at voltages a few thousand times the Josephson voltage $h\nu/2e$. The external rf radiation also induced stable dc voltages on unbiased bulk samples, suggesting a practical mode of microwave detection. The analogy of this bulk superconducting system with a magnetic spin system is discussed. (auth)

13972 (IAE-2316) STRUCTURE AND TESTING OF COMBINED MAGNETIC SUPERCONDUCTING SOLENOID KS-250. Cheremnykh, P. A.; Churakov, G. F.; Keilin, V. E.; Klimenko, E. Yu.; Kulyamzin, A. N.; Monoszon, N. A.; Novikov, S. I.; Ostroumov, Yu. N.; Rozhdestvenskii, B. V.; Saoanskii, I. I.; Samoilov, B. N.; Chernoplekov, N. A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1973. 15p. (In Russian). INIS.

The characteristics of the construction and the test results of the superconducting solenoid with a combined magnetic system KS-250 are reported. The solenoid generates at the geometric center of the magnetic field intensities of 5.6 T at a current of 900 amp. (tr-auth)

13973 (KFK-1991) EXPERIMENTAL STUDIES OF SUPERCONDUCTING Nb HELICAL RESONATORS IN THE REGION OF 100 MHz. Piosczyk, B. (Kernforschungszentrum Karlsruhe (F.R. Germany). Inst. fuer Experimentelle Kernphysik). Apr 1974. 94p. (In German). INIS.

Thesis.

Peak magnetic rf-fields up to 1,250 gauss and residual resistance as low as 10^{-9} Ω were obtained. Two contributions to the

residual resistance were studied systematically: the contribution of gases condensed on the surface (N_2, O_2, CO_2, air, and N_2/O_2-mixtures), and of frozen-in-flux resulting from externally applied dc magnetic fields up to 6 gauss. The thickness of the condensed gases studied varied from approximately 1 monolayer to 10^4 monolayers. The loss factor in these condensed layers was determined. Losses in the N_2/O_2 layers were particularly large compared to those found in pure N_2 layers. This difference is caused by the magnetic moment of the O_2 molecule. The additional losses in the 100 MHz-region due to frozen-in-flux show different behavior from losses in the GHz-region. In particular, the additional resistance increases with increasing rf-field. This can be explained by a model in which the flux lines perpendicular to the surface are bent by the rf-induced Lorentz force. This explanation leads to a pinning frequency of about 20 MHz. (auth)

13974 (KFK-EXT-3/74-9) TEST AND OPERATION OF HELIUM LOW-TEMPERATURE DEVICES FOR APPLIED SUPERCONDUCTIVITY. Katheder, H.; Lehmann, W.; Spath, F. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Experimentelle Kernphysik). Apr 1974. 37p. (In German). Dep. NTIS (US Sales Only) $5.00.

Separate abstracts were prepared for the three papers presented. (WHK)

For abstracts of individual papers see: 13975, 13976, and 14731.

13975 (KFK-EXT-3/74-9, pp A1-A14) TEST AND OPERATION OF He II LOW-TEMPERATURE INSTALLATION. Spath, F. Apr 1974. (In German).

In test and operation of helium low-temperature devices for applied superconductivity.

At the institute two large He II refrigerators are used for research work in the field of superconductivity. The execution and results of the acceptance tests and the problems encountered during utilization and operation of the refrigerators are reported. For proving the specifications, extensive tests were carried out. The measured capacity at 1.8°K was higher than the guaranteed value. Especially the leak-rate (< 20 Nl/h) and the oil-free compressors were carefully checked. The refrigerator built by Linde delivers 380 watts and has been operated about 10,000 hrs since 1971. The machine built by Messer Griesheim delivers 350 watts and was put into normal operation in 1974. (auth)

13976 (KFK-EXT-3/74-9, pp B1-B7) OPERATIONAL EXPERIENCES WITH A He I LOOP AT A 300-W REFRIGERATOR. Katheder, H. Apr 1974. (In German).

In test and operation of helium low-temperature devices for applied superconductivity.

At the IEKP-Karlsruhe Institute a 300 watt refrigerator was put into operation in 1971. For endurance tests of superconducting magnets a 4.4°K refrigeration cycle was installed. The flow diagram used is discussed and experimental data concerning cryostat performance, helium-transfer lines, cooldown mode, cooldown time, energy release into the helium bath and the reaction of the refrigerator are given. (auth)

13977 (LBL-3182) LOW FREQUENCY NOISE IN JOSEPHSON JUNCTIONS. Clarke, J.; Hawkins, G. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Oct 1974. Contract W-7405-eng-48. 4p. (CONF-740957-29). Dep. NTIS $4.00.

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974).

Using a high resolution SQUID voltmeter, we have measured the spectrum of low frequency voltage fluctuations across a thin-film Josephson tunnel junction biased at a constant current I greater than the junction critical current I_c. We find that the frequency dependence of the voltage spectrum $V^2(f)$ may be accurately represented by the power law $V^2(f) \propto f^{-1}$ over the frequency range of our data: $10^{-2} < f < 10$ Hz. The dependence of the magnitude of the spectra at any single frequency upon the value of the bias current I and upon the sample temperature T supports our hypothesis that the observed voltage fluctuations arise from a modulation of the junction critical current I_c by equilibrium, thermodynamic temperature fluctuations in the active junction volume. We are able to interpret our measurements in terms of the semi-empirical theory of Clarke and Voss for the low frequency fluctuation spectrum of systems obeying a diffusion equation. This interpretation provides design criteria which may prove useful in reducing the level of long-term drifts in systems employing Josephson tunnel junctions. (auth)

13978 (LBL-3191) RELIABLE DC SQUID MADE WITH TUNNEL JUNCTIONS. Clarke, J.; Goubau, W. M.; Ketchen, M. B. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Oct 1974. Contract W-7405-eng-48. 6p. (CONF-740957-30). Dep. NTIS $4.00.

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974).

D. C. SQUIDS of cylindrical geometry have been fabricated using $Nb-NbO_x-Pb$ tunnel junctions. The SQUIDS can be thermally cycled repeatedly and cooled in the earth's magnetic field without significant loss of perfromance. Flux resolution of $3 \times 10^{-5}\ \phi_0/\sqrt{Hz}$ above a frequency of 1 Hz has been achieved through optimization of electronic circuitry and careful shielding. Fluctuations and drift in the temperature of the helium bath are found to be the major source of long-term SQUID noise. With a simple temperature stabilizer, drift has been reduced to less than 8×10^{-5} ϕ_0/hr over a three hour period. (auth)

13979 (NBA-TN-830) NBS CRYOGENIC THERMOMETRY AND THE PROPOSED CRYOGENIC EXTENSION OF THE IPTS. Cataland, G.; Hudson, R. P.; Bangum, B. W.; Marshak, H.; Plumb, H. H. (National Bureau of Standards, Washington, D. C. (USA)). May 1974. 35p. (COM-74-50532). GPO $0.65.

The article outlines a comprehensive and long-term program being carried out by NBS scientists of the cryogenic physics and temperature sections. The goals of the program are the extension IPTS 68 below 13.81°K and the development of devices which make practical realizations of that scale convenient and reliable. We propose to contribute to international adoption of a thermodynamically accurate scale below 13.81°K by analyzing the results of three thermometers: the NBS acoustical thermometer (already in operation for several years), noise thermometry using the Josephson effect (recently developed), and gamma-ray anisotropy thermometry (recently studied in detail at NBS). Such a temperature scale will most likely be disseminated by the use of certain superconductors as thermometric reference points. Practical interpolation devices will be based on the principles of nuclear and electronic paramagnetism, nuclear quadrupole resonance, and nuclear magnetic resonance. Details of operation, measurement schemes and experimental progress made to date are included in nine appendices. (GRA)

13980 (NBSIR-74-363) HEAT TRANSFER IN PULSED SUPERCONDUCTING MAGNETS. Arp, V.; Giarratano, P. J.; Hess, R. C.; Jones, M. C. (National Bureau of Standards, Boulder, Colo. (USA)). Jan 1974. 138p. (COM-74-11053). NTIS $10.00.

The first section of the report summarizes design problems for the development of advanced superconducting pulsed magnets, leading to recommendations for future work, primarily in (1) evaluation of eddy-current, hysteresis, and frictional losses, and (2) transient heat transfer between the superconductor and the helium. Two subsequent sections report measurements of forced convection heat transfer respectively to subcooled liquid helium and to supercritical helium just above the critical pressure. (GRA)

13981 (RL-74-134) THERMALLY SWITCHED FLUX PUMP. Homer, G. J.; Houzego, P. J.; Scott, C. A.; Wilson, M. N. (Science Research Council, Chilton (UK). Rutherford Lab.). Oct 1974. 6p. Dep. NTIS (US Sales Only) $4.00.

A superconducting power supply (flux pump) of the transformer rectifier type in which the rectification is produced by thermal switching is described. The supply is intended for use with a superconducting magnet. At an operating current of 1000 A the pump can charge a magnet at about 20 W with an efficiency greater than 93%. In separate battery tests the pump has developed 38 W at a current of 1500 A. Design of an improved 1500 A, 500 W supply is in hand. (auth)

13982 SUPERCONDUCTING CAVITY RESONATOR. Martens, H. (to Siemens Aktiengesellschaft). US Patent 3,845,424. 29 Oct 1974. Priority date 24 Dec 1971, F. R. Germany. 8p.

In a superconducting cavity resonator, the need to separate the input and output coupling lines from the resonator cavity by the use of vacuum tight microwave windows is avoided by having the tubular lines for coupling electromagnetic energy into and out of the cavity open into the resonator cavity from below the cavity. (Official Gazette)

13983 MULTI-FILAMENT COMPOSITE SUPERCONDUCTOR WITH TRANSPOSITION OF FILAMENTS AND METHOD OF MAKING SAME. Critchlow, P. R.; Zeitlin, B. A. (to Airco Inc.). US Patent 3,829,964. 20 Aug 1974. Filed Date 11 Sep 1973. 6p.

A multi-filament superconducting composite composed of a plurality of segments that is intrinsically stable is described. The individual segments are multi-filament composites that have been twisted after assembly and mechanical working and thereafter subsequently deformed. The deformed segments can be triangular or rectangular and are assembled into a second composite. After assembly the second composite is once again twisted. This second twisting transposes the filaments within the segments,

thereby producing a superconductor that is resistant to flux jumps induced by self-field losses. (Official Gazette)

13984 METHOD OF FABRICATING A COMPOSITE SUPERCONDUCTOR INCLUDING A SUPERCONDUCTIVE INTERMETALLIC COMPOUND. McDougall, I. L.; Barber, A. C. (to Imperial Metal Industries (Kynoch) Ltd.). US Patent 3,829,963. 20 Aug 1974. Priority Date 4 Feb 1971, United Kingdom of Great Britain and Northern Ireland. 8p.

A method of manufacturing a superconductor comprising a superconductive intermetallic compound of at least two elements is described. The method includes the steps of producing a composite precursor comprising at least one filament which comprises one of said elements and is embedded in and supported by a matrix material, converting at least part of the matrix material to a substance comprising the remainder of said elements, and reacting together said elements to produce said compound. (Official Gazette)

Heat Transfer and Fluid Flow

Refer also to abstracts 15630, 15631, and 15720.

13985 (RD/B/N-3028) DESIGN OF AN EXPERIMENT FOR MEASURING THERMAL DIFFUSION IN A RECIRCULATING SODIUM FLOW. Freeman, A. R. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). May 1974. 27p. Dep. NTIS (US Sales Only) $4.50.

In order to establish water modeling as a technique for determining velocity and temperature distributions in liquid metal reactors, information is required about the turbulent diffusivities of momentum and heat in both water and liquid metals, particularly in regions of recirculating flow. It is planned to make measurements in the recirculation zone downstream of a sudden expansion in a pipe using two identical test sections, one, already built, operating in water, the other in liquid sodium. The design parameters necessary for the optimum operation of the sodium rig have been considered, drawing where necessary on experience gained from the water rig. A design is arrived at for a hot sodium injection system to enable a temperature profile to be generated at the expansion inlet. The position of this injector has been optimized to give the best possible hydrodynamic and thermal conditions in the recirculation zone. The thickness of the test section lagging to give near adiabatic wall temperatures has also been considered. Finally, the best range of operating conditions is determined, bearing in mind buoyancy effects, and it is concluded that the sodium rig will probably best be operated at a Reynolds number of approximately 8×10^4. (auth)

13986 (WANL-TME-795) EFFECT OF VERTICAL FLOW AT LOW FLOWRATES ON TRANSIENT TWO-PHASE FLOW AND BOILING HEAT TRANSFER. Chi, J. W. H.; Edmiston, J. M.; Hansen, O. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 22 May 1964. 19p. Dep. NTIS $4.00.

An experimental study on the chill-down of an aluminum test section by vertical upflow of hydrogen was carried out. Due to the limitations on the operating pressures, only low flowrates (less than 4.5×10^{-3} lb/sec) were investigated. The data indicated that for these flowrates, chilldown occurred with predominantly mist flow. For this condition, it was shown that local heat flux can be calculated by the assumption of a homogeneous fluid with average bulk temperatures. In the absence of data at high flowrates, the general correlation proposed previously for forced convective boiling heat transfer could not be verified. (auth)

13987 (WANL-TNR-056) AN INTERIM STUDY OF SINGLE PHASE HEAT TRANSFER CORRELATIONS USING HYDROGEN. Thomas, G. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Apr 1962. 20p. Dep. NTIS $4.00.

Single phase heat transfer measurements on hydrogen and helium have been reviewed in view of possible application to NERVA operation. A correlation is recommended but it should be regarded as tentative due to the use of different fluid properties by various investigators, the use of bulk or film properties, the use of average values of heat transfer coefficient (in the Nerva application local values change rapidly) and problems of wall temperature and the ratio of wall temperature to bulk temperature, entrance effects, different correlating functions, etc. It should be used with caution below 90°R. (LTN)

13988 (WANL-TNR-059) POISSONIAN AND LAPLACIAN FIELD ANALOGUE FOR THE SOLUTION OF TWO DIMENSIONAL COMPLEX HEAT CONDUCTION PROBLEM. Pierce, B. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jun 1962. 35p. Dep. NTIS $4.75.

The theory, possible applications and accuracy of the Poissonian and Laplacian fields analogue (PAL analogue) are presented. The PAL analogue is a geometrically similar analogue that uses a conducting paper having geometric similarity to the body being investigated. The electric current can be introduced over an area or in lumped form at grid points (approximating the heat flow pattern closely if a sufficiently fine grid is used). The PAL analogue determines the two dimensional equipotential (isothermal) patterns of Poissonian fields created by uniform or non-uniform sources (heat generation). The analytical results of a number of steady-state problems are compared with the results from the PAL analogue to demonstrate its accuracy. (auth)

Materials Testing

Refer also to abstract 13941.

13989 (WANL-TME-2693) CRYOGENIC THERMAL SHOCK OF SHIELD MODULE. Final Test Report. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Apr 1970. 36p. Dep. NTIS $5.00.

A hexagonal shield module of BATH material was thermally shocked at -27°F/s on its periphery by flowing chilled helium (-320°F) through the module ID at a mass flow rate of 1.1 lb/s. A ramp rate of -24°F/s is the calculated shield module temperature ramp associated with propellant flow and temperature requirements to simulate a mid-map startup nozzle chamber temperature ramp of 150°F/s. The resultant strains were converted to stresses and compared with calculated stresses. The maximum calculated tensile stress was 6300 psi and the corresponding minimum ultimate strength was 15,200 psi. The post-test calculated stresses and the test results were in reasonable agreement. There was no observable damage to the BATH shield module. (auth)

13990 OVERVIEW OF NONDESTRUCTIVE INSPECTION TECHNIQUES. Gericke, O. R. (Army Materials and Mechanics Research Center, Watertown, MA). pp 117-160 of Fracture Mechanics of Ceramics. Vol. 1. Bradt, R. C. (ed.). New York; Plenum Publishing Corp. (1974).

From conference of fracture mechanics of ceramics; University Park, Pennsylvania, USA (11 Jul 1973). See CONF-730707-P1; ISBN-0-306-37591-5(Vol.1).

This overview of current NDT principles and techniques includes criteria for the proper selection of effective test methods. The process of selecting and developing suitable test procedures for a particular quality assurance purpose is governed by several factors: the nature of the flaws anticipated, the characteristics of materials and structures involved, and the location and configuration of defects. In discussing the various options available to the designer or user of nondestructive test procedures, one must first attempt to clarify the scientific as well as the semantic problem which has arisen from the rapid proliferation of inspection techniques. The complexity of the subject can be reduced by establishing three major categories of test disciplines under which all currently known NDT methods can be classified: motion-of-matter testing, electromagnetic testing, and probing media testing. Using this grouping, individual NDT techniques are discussed with primary emphasis being placed on the general principles and on recent innovations and improvements of the technique. (15 fig) (auth)

Nuclear Explosions

Refer also to abstracts 14042 and 14059.

13991 (CEA-R-4605) EVOLUTION OF TEMPERATURE AND RADIOACTIVITY IN A NUCLEAR CAVITY. Balard, F.; Collin, M.; Cousigne, M.; Dupuis, M. C.; Humbert-Droz, C. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92-Montrouge (France)). Oct 1974. 19p. (In French). Dep. NTIS (US Sales Only) $4.00.

The use of a nuclear cavity for hydrocarbon storage requires a reliable assessment of characteristic thermal and radioactive data for the cavity in order to optimize rational exploitation. Several theoretical models describing the different steps of the nuclear cavity evolution have been developed. The model dealing with cavity evolution before collapse enables calculation of thermodynamic data (pressure, temperature, composition of gases, temperature, and quantity of melted rock) and distribution of radioactivity in the different phases (especially the nature of tritiated

compounds and the entrapment of tritiated water in the melt). Two numerical models have been developed to account for the collapse thermochemical effects; one describes the rubble falling into the molten rock, the partial fusion of rubble and lava solidification; the other describes a quick gas transport in the nuclear chimney during its formation, gas freezing, water condensation at cold rubble surface and gaseous chemical reaction kinetics. After the cavity collapse, thermal transfers are governed essentially by water vaporization condensation, natural gas convection, and further by slow conduction of heat and water thermomigration through neighboring sites. The results of theoretical calculations are in good agreement with experimental data gathered from the French Sahara shots. (auth)

13992 (JPRS-63502) PEACEFUL NUCLEAR EXPLOSIONS AND THE ENVIRONMENT. Izrael, Yu. A. 22 Nov 1974. Translation of Mirnye Yadernye Vzryvy i Okruzhayushchaya Sreda, Leningrad, 1974. 144p. NTIS.

Separate abstracts were prepared for the introduction and eight chapters in the book. (TFD)

For abstracts of individual chapters see: 13993–14001.

13993 (JPRS-63502, pp 5-11) INTRODUCTION. The Possibilities of Using Underground Nuclear Explosions for Peaceful Purposes. 22 Nov 1974. Translated from pp 6-12 of Mirnye Yadernye Vzryvy i Okruzhayushchaya Sreda, Gidrometeoizdat, Leningrad, 1974.

In peaceful nuclear explosions and the environment.

Plans for the utilization of underground explosions for peaceful purposes, as reflected in the world literature, are briefly described. (TFD)

13994 (JPRS-63502, pp 12-27) GENERAL PICTURE OF AN UNDERGROUND NUCLEAR EXPLOSION. 22 Nov 1974. Translated from pp 13-28 of Mirnye Yadernye Vzryvy i Okruzhayushchaya Sreda, Gidrometeoizdat, Leningrad, 1974.

In peaceful nuclear explosions and the environment.

Very complex processes take place during an underground nuclear explosion. These processes are described for both vented and contained explosions. (TFD)

13995 (JPRS-63502, pp 28-41) RADIOACTIVE PRODUCTS OF UNDERGROUND NUCLEAR EXPLOSIONS. 22 Nov 1974. Translated from pp 29-41 of Mirnye Yadernye Vzryvy i Okruzhayushchaya Sreda, Gidrometeoizdat, Leningrad, 1974.

In peaceful nuclear explosions and the environment.

The total amount of radioactivity formed during an underground nuclear explosion is determined by the number of fission fragments, i.e., by the yield of the explosion due to fission, and also by the induced activity formed as a result of the interaction of neutrons with nuclei of the elements present in the blast zone. The formation of radioactive products and their properties are discussed. (TFD)

13996 (JPRS-63502, pp 42-49) DISTRIBUTION OF RADIOACTIVITY IN CONTAINED EXPLOSIONS. 22 Nov 1974. Translated from pp 42-48 of Mirnye Yadernye Vzryvy i Okruzhayushchaya Sreda, Gidrometeoizdat, Leningrad, 1974.

In peaceful nuclear explosions and the environment.

A knowledge of the distribution of the radioactive products in the fused, crushed and fractured rock during a contained nuclear explosion is of great importance for the determination of the future behavior of these products. Most of these products (basically high-melting) are firmly fixed by the molten rock during its solidification process. Only a small fraction of such products dissolves and is carried away by ground waters. The volatile products may spread into the zone of crushing and cracking of the rocks after the collapse of the cavity, and the most volatile (chiefly gaseous) products, under certain conditions, may seep into the atmosphere. The distribution of radioactive products determines the possibilities of contamination of the product (natural gas, oil, ore), the recovery of which is organized or intensified by means of a contained explosion. (TFD)

13997 (JPRS-63502, pp 50-55) ESCAPE OF RADIOACTIVE PRODUCTS INTO THE ATMOSPHERE DURING UNDERGROUND NUCLEAR EXPLOSIONS. 22 Nov 1974. Translated from pp 49-54 of Mirnye Yadernye Vzryvy i Okruzhayushchaya Sreda, Gidrometeoizdat, Leningrad, 1974.

In peaceful nuclear explosions and the environment.

In deep explosions, radioactive products can escape only through fissured layers of soil, located between the cavity and the earth's surface. According to published data, the maximum size of zones of crushed and fissured rock beyond the rubble chimney is 1.5 radii of the cavity beneath the center of the explosion, from 2 to 3 radii in the horizontal direction and up to 8 radii above the center of the explosion. The penetration of explosion products (basically volatile or gaseous) into radial cracks is a rather rapid process. The surfaces of rocks in such cracks are altered somewhat as a result of the temperature action of the gases. Through cracks in the rubble chimney or in the zone of overlapping of radial cracks above the blast cavity and cracks formed as a result of splitting processes, radioactive products may leak from the cavity of a contained underground explosion into the atmosphere under the influence of residual pressure as a result of diffusion or ventilation. The escape of the products into the atmosphere through such cracks takes a considerable amount of time. Consequently the isotopes of only inert gases or extremely volatile elements (halogens for example) may escape into the atmosphere. The isotopes ^{85m}Kr, ^{87}Kr, ^{88}Kr, ^{133}Xe, ^{135}Xe, and ^{136}Xe should be expected to escape into the atmosphere most effectively. Some of these isotopes, as they decay, produce nongaseous (short-lived) radioactive products such as ^{85}Rb and ^{133}Cs. Radioactive iodine isotopes may also escape. (TFD)

13998 (JPRS-63502, pp 56-97) ATMOSPHERIC SPREADING AND FALLOUT OF PRODUCTS OF NUCLEAR EXPLOSIONS. 22 Nov 1974. Translated from pp 55-95 of Mirnye Yadernye Vzryvy i Okruzhayushchaya Sreda, Gidrometeoizdat, Leningrad, 1974.

In peaceful nuclear explosions and the environment.

The mechanisms by which atmospheric radioactivity and fallout occur from nuclear cratering explosions are discussed. (TFD)

13999 (JPRS-63502, pp 98-112) GAMMA-RADIATION FIELD OF RADIOACTIVE FALLOUT, CLOUD, AND STREAM OF RADIOACTIVE GASES. 22 Nov 1974. Translated from pp 96-109 of Mirnye Yadernye Vzryvy i Okruzhayushchaya Sreda, Gidrometeoizdat, Leningrad, 1974.

In peaceful nuclear explosions and the environment.

The appearance of radioactive products in the atmosphere after underground nuclear explosions, or their fallout onto the earth's surface, entails the development of fields of nuclear emissions. The gamma radiation field is considered to be the most hazardous, particularly in the surface layer of the atmosphere, which is the habitat of most of the living organisms on the earth, and this field requires careful analysis in this connection. The gamma-field contains information about emitters and their distribution; information obtained on the basis of measurements of field parameters helps to give an idea of the quantity of radioactive products that enter the atmosphere, the conditions of their formation, and consequently about the source of the pollution. This makes it possible, in the final analysis, to construct a diagram for the forecasting of the propagation of radioisotopes and radioactive fallout and of the emission fields corresponding to them. (TFD)

14000 (JPRS-63502, pp 113-130) MIGRATION AND BIOLOGICAL ACCESSIBILITY OF THE RADIOACTIVE PRODUCTS OF AN EXPLOSION. 22 Nov 1974. Translated from pp 110-126 of Mirnye Yadernye Vzryvy i Okruzhayushchaya Sreda, Gidrometeoizdat, Leningrad, 1974.

In peaceful nuclear explosions and the environment.

The radioactive products that enter the environment after underground nuclear explosions as a result of various natural processes, migrate and are redistributed among various zones. Radioactive isotopes are spread by surface and ground waters and by the wind. Radioactive products find their way into vegetation and animals, and they may enter the human organism through the food chains. The secondary processes of migration and redistribution of radioactive isotopes are related chiefly to solubility, i.e., the capacity of these isotopes to be transformed from fallout particles into aqueous solutions. Because of the possibility of world-wide utilization of nuclear explosions, this is considered to be an especially important problem. Data collected during the 1003 Soviet explosions are presented. (TFD)

14001 (JPRS-63502, pp 131-133) CONCLUSIONS. An Approach to the Problems of Radiation Safety During Peaceful Nuclear Explosions, Providing Effective Protection of the Environment. 22 Nov 1974. Translated from pp 127-129 of Mirnye Yadernye Vzryvy i Okruzhayushchaya Sreda, Gidrometeoizdat, Leningrad, 1974.

In peaceful nuclear explosions and the environment.

A general policy statement and measures necessary to protect the environment from underground nuclear explosions are presented. (TFD)

14002 (NVO-152) SUMMARY REPORT: CENTRAL NEVADA TEST AREA DEMOBILIZATION AND RESTORATION ACTIVITIES. (Holmes and Narver, Inc., Las Vegas, Nev. (USA). On-Continent Test Div.). Dec 1974. 63p. Dep. NTIS $5.45.

This report has been prepared to document Atomic Energy Commission (AEC) demobilization and restoration activity at the Central Nevada Test Area (CNTA) through November of 1974. Although the CNTA is not completely demobilized and a

final demobilization is not planned in the immediate future, recent site inspections made by Bureau of Land Management (BLM) personnel have tentatively resulted in the BLM's oral acceptance of demobilization work performed during the summer and fall of 1973. The purpose of this report is to: (1) identify the facilities, equipment, and materials that have been demobilized and the land areas that have been restored; (2) document the measures taken to plug, cap, or otherwise dispose of drilled holes; (3) identify land areas that have been returned to the BLM and Nye County; (4) indicate the facilities, land areas, materials, and supplies that remain; and (5) provide other pertinent data. (auth)

Protective Structures and Equipment

Refer also to abstract 14342.

14003 (DP-MS-74-36) VENTILATION SYSTEMS FOR LABORATORIES HANDLING RADIOACTIVE MATERIALS. Walsh, J. P.; Hale, R. J. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). 1975. Contract AT(07-2)-1. 27p. (CONF-750106-1). Dep. NTIS $4.50.

From symposium on ventilation and filtration equipment for nuclear facilities; Atlantic City, New Jersey, USA (26 Jan 1975).

A general review is presented of the ventilation systems designed for handling radioactive materials at the Savannah River Laboratory. A summary of the development of suitable design criteria for such ventilation systems is given. Several distinct ventilation systems have been developed within the framework of these criteria. The filtration, control, and regulating methods used with the various systems are also described. Operating experience with installed systems is reviewed with respect to system effectiveness, reliability, ease of control, and stability. The ventilation systems are grouped by operating or design characteristics. Typical examples of each group are described with a consideration of such factors as effectiveness, reliability, and service requirements. The application of these systems to the ventilation of high-level-activity cells and other enclosures is also described. (auth)

14004 (LA-5784-PR) PERFORMANCE OF MULTIPLE HEPA FILTERS AGAINST PLUTONIUM AEROSOLS: JANUARY 1-JUNE 30, 1974. Elder, J. C.; Ettinger, H. J.; Gonzales, M.; Tillery, M. (Los Alamos Scientific Lab., N. Mex. (USA)). Nov 1974. Contract W-7405-eng-36. 11p. Dep. NTIS $4.00.

The efficiency of a multiple HEPA filter system (three stages) has been evaluated using laboratory-produced plutonium oxide aerosols having activity median aerodynamic diameters (amad's) ranging from 0.22 to 0.44 μm. Extensive efforts have been made to improve the accuracy of assessing the efficiency of HEPA #3. These efforts have consisted of increasing the aerosol concentration challenging HEPA #3 and improving the assessment of the penetrating concentration. The more accurate measurements of HEPA #3 performance have resulted in the measurement of higher efficiencies for this stage. For the eight runs made during the reporting period, all HEPA #3 efficiencies were in excess of 99.99%. The average efficiencies measured for HEPA #1 and HEPA #2 were also in excess of 99.99%. The runs made during the reporting period indicated that the minimum-size aerosol that can be practically produced by centrifugal milling and ultrasonic agitation will have an amad $\simeq$ 0.2 μm. The investigation of new techniques to produce plutonium aerosols having amad's $\leq$ 0.1 μm has been initiated. The efficiency of filters that have been exposed to alpha irradiation for periods up to 12 months were measured. No decrease in performance could be detected in these filters. (auth)

Safety Engineering

Refer also to abstract 14342.

ENVIRONMENTAL AND EARTH SCIENCES

Minerals and Ores

14005 THE URANIUM PARAGENESIS OF MITTERBERG (SALZBURG, AUSTRIA). Siegl, W. (Montanistische Hochschule, Leoben (Austria). Inst. fuer Geologie und Lagerstaetten). Tschermaks Mineral. Petrogr. Mitt.; 17: No. 4, 263-275(Apr 1972). (In German).

Study of the radioactive samples mainly out of some old dumps from Mitterberg, Salzburg (Austria), advanced a special paragenesis: uranite–graphite–gold. The accompanying phases quantitatively can be neglected. The older U-phase is brannerite. In the host rock ("violet shale") black uranium-ore combined with partly structurized carbonaceous matter was determined. In this environment brannerite was found partly in contact with the organic matter and partly in slightly metamorphic sandstone as an authigenic formation. Mobilization out of the country rock is taken into consideration for uraninite, graphite, brannerite and some of the accompanying ore minerals. (auth)

14006 A COMPARISON OF ZIRCON U–Pb AND WHOLE-ROCK Rb–Sr SYSTEMS IN THREE PHASES OF THE CARN CHUINNEAG GRANITE, NORTHERN SCOTLAND. Pidgeon, R. T. (Scottish Research Reactor Centre, East Kilbride (UK)); Johnson, M. R. W. (Edinburgh Univ. (UK)). Earth Planet. Sci. Lett.; 24: No. 1, 105-112(Nov 1974).

Zircons from two biotite granite units, the Inchbae rock and Lochan a'Chairn rock, from the 560-m.y. old Carn Chuinneag granite contain excess radiogenic lead. No excess radiogenic lead has been found in a third granite unit, the riebeckite gneiss. The excess radiogenic lead is attributed to zircon xenocrysts that have partially survived the formation of the granite magma and been incorporated in newly crystallizing zircon. The zircon U–Pb systems from the Inchbae rock suggest 1500 ± 200 m.y. as the age of its source rocks. The absence of excess radiogenic lead in the riebeckite gneiss zircons is attributed to either the progressive exclusion of zircon xenocrysts during formation of the Lochan a'Chairn rock and riebeckite gneiss magmas or to a decrease in the stability of the zircon with increasing alkalinity of the magma. Zircons from the Inchbae rock have not been isotopically disturbed since granite emplacement. On the other hand zircons from the finer-grained Lochan a'Chairn rock have been slightly disturbed and the riebeckite gneiss zircons have experienced a strong recent isotopic disturbance. This suggests a correlation between granite type and the stability of the zircon U–Pb isotopic systems, though the mechanism is not understood. The stability of the Rb–Sr whole-rock systems can also be correlated with rock type. Whereas the Inchbae and Lochan a'Chairn rocks have not been isotopically disturbed since granite emplacement the Rb–Sr whole-rock systems of the riebeckite gneiss were strongly disturbed ca. 425 m.y. ago. (auth)

14007 METHOD FOR URANIUM EXPLORATION EMPLOYING RADIOACTIVE RECONNAISSANCE AND ASSAY LOGGING. Givens, W. W. (to Mobil Oil Corp.). US Patent 3,845,299. 29 Oct 1974. Filed date 13 Apr 1973. 12p.

Uranium exploration employing delayed fission neutrons from uranium in borehole logging operations to obtain both a reconnaissance log to identify possible uranium ore bearing zones and an assay log of such zones in order to obtain a qualitative indication of uranium content is described. In obtaining a DFN log a neutron source is operated in the borehole in order to irradiate adjacent earth material with repetitive bursts of fast neutrons which are spaced by time intervals greater than the time required for dissipation of neutrons originating in the burst. A detector is operated in order to detect delayed neutrons resulting from neutron fission of uranium. The reconnaissance and assay logging operations may be carried out in conjunction with natural gamma ray logs and also in conjunction with a logging operation to obtain the response of the earth material to moderation and absorption of neutrons. Also disclosed is a delayed fission neutron logging system which may be employed in both reconnaissance and assay logging. (Official Gazette)

14008 LOOKING FOR OIL SOEKOR FINDS COAL IN SOUTH WEST. Coal, Gold Base Miner. S. Afr.; 33-37(Jan 1974).

Drilling operations carried out in the oil search up to date in the land and offshore areas in South Africa have produced significant and encouraging results. The oil search undertaken by Soekor, besides producing a commercial gas find off the coast of Plettenberg Bay, also pointed to a large uranium province in the central Karoo and an exceptional coal discovery in southwest Africa. The results, expenditures, and offshore seismic survey programme are discussed. (INIS)

14009 GEOLOGICAL CONDITIONS IN THE AREA OF THE URANIUM ORE DEPOSIT AT OKROUHLA RADOUN NEAR JINDRICHUV HRADEC. Mrazek, P. Sb. Geol. Ved, Loziskova Geol.; 15: 83-97(1972). (In Czech).

New findings are outlined such as were gained in a geological survey made in the area of catazonal metamorphic rocks of the Moldanubian type with numerous apophyses of granitoid intrusion of the Variscian age Klenov massif. The late Variscian radial tectonics has created several fractures running from north to south, in some places with mineral deposits. The most significant of these locations is the hydrothermal vein mineralization with uraninite, galenite, chalcopyrite, sphalerite. The main suture of the fracture was reactivated by neotectonics, thus dispersing the uranium mineralization tectonically and hydrogeologically in the form of uranium blacks. (Nucl. Sci. Abstr. Czech.)

14010 URANIUM DEPOSIT AT DAMETICE, SOUTH OF HORAZDOVICE. Janout, T. Sb. Geol. Ved, Loziskova Geol.; 15: 67-79(1972). (In Czech).

A uranium deposit located in the Moldanubian mineral layers is discussed. The deposit is tectonically linked with the quartz lode in the north-east direction. By its mineral content, the deposit is of a sulphide-uraninite type with a powerful zone of oxidation. The history of the discovery of the deposit, the geological conditions thereof and a brief survey of work in the area are presented. (Nucl. Sci. Abstr. Czech)

Radioactive Effluents

Refer also to abstracts 14017, 15724, 15727, 15728, 15730, and 15746.

14011 (BNL-19317) ENVIRONMENTAL RADIATION RISKS FROM NUCLEAR POWER PLANT EFFLUENTS. Hull, A. P. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 15p. (CONF-741052-1). Dep. NTIS $4.00.

From 102nd annual meeting of American Public Health Association; New Orleans, Louisiana, USA (20 Oct 1974).

Standards currently in force in the USA for maximum permissible release of radionuclides from nuclear facilities are reviewed. The risks occasioned by current nuclear power effluents increasingly appear to be far smaller than those occasioned by other practicable and available means of balancing our national energy budget. The overall expenditures for control of liquid and gaseous wastes to prevent the release of radionuclides to the environment in amounts compatable with present standards will occasion only a small increment in the overall costs of nuclear power. This is seen as a small price to pay if it will secure public confidence in nuclear power plants. (CH)

14012 (GA-A-13174) CARBON-14 IN THE HTGR FUEL CYCLE. Brooks, L. H.; Heath, C. A.; Kirstein, B.; Roberts, D. G. (General Atomic Co., San Diego, Calif. (USA)). 29 Nov 1974. Contract AT(04-3)-167. 53p. Dep. NTIS $5.45.

The natural state of the earth's ^{14}C cycle is examined and the effects of releasing man-made ^{14}C to it are studied with a view toward determining the consequences that increasing the total ^{14}C content in the earth will have on human health. Initial studies on ^{14}C generation indicate that the level in a fuel block may be in the region of 0.16 Ci per fuel element and will be released as CO_2 during reprocessing. The annual release was calculated knowing the reprocessing rate. It is initially 0.9 kg/year in 1985 and increases to 5.85 kg/year in 2000, the total cumulative mass released being 50.4 kg by 2000 and 255 kg by 2035. Because this quantity is continually being shared among the other reservoirs, the quantity in the atmosphere is less than 255 kg. This results in a dose rate less than 0.4 mr/year, which is a very small dose rate compared with 1.6 mr/year for C-14 and 130 mr/year for the total sea-level background. The effect of releasing C-14 from the reprocessing plant stack is minimized by increasing the stack height. It is calculated that the ingestion dose rate to a person at the boundary who consumes one-third of his carbon intake from locally grown vegetables is less than 5 mr/year with a stack height of 500 feet or more. The dose commitment calculated for the entire forecasted HTGR market over 50 years was found to be 7.3 mr. This compares with 6500 mr for the background dose commitment over the same period. It is

concluded that the increase in radiation levels due to the release of C-14 is very low compared with that of the background. (auth)

14013 (JPRS-62414) TRANSLATIONS ON ENVIRONMENTAL QUALITY. Number 41. Translated from Various Journals (8 Jul 1974). 48p. NTIS $3.25.

The serial report contains translations from the world press of articles as follows: further reactions to PRC nuclear explosion; (various sources, various dates); Santos Bay (Brazil) heavily polluted; high mercury content of fish in Santos estuary; study on cause of fish deaths in Paraiba River (Brazil); satellite photographs used to investigate river pollution; sea pollution; success of new antipollution methods described (USSR); need for pollution control measures stressed; Kirgiz central committee and council of ministers resolution on environmental protection; power plant development will affect Rhine temperature; new discovery for decontamination of Rhine developed; stack gas desulfurization possibilities discussed; sulfate cellulose plant raises pollution question; increasing energy demands conflict with antipollution measures, automobile industry reacts to antipollution laws. (GRA)

14014 RADIATION HAZARDS TO THE POPULATION RESULTING FROM CONVENTIONAL AND NUCLEAR ELECTRIC POWER PRODUCTION. Jaworowski, Z.; Bilkiewicz, J.; Dobosz, E.; Grzybowska, D.; Kownacka, L.; Wronski, Z. (Central Lab. for Radiation Protection, Warsaw). pp 403-412 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); CONF-731117-(P1).

Results of studies are reported that indicate that the quantities of ^{226}Ra dispersed by the combustion of fossil fuel for power production are sufficiently high to cause a measurable increase of the levels of the radionuclide in the environment, not only neighboring on the large power plants but also in regions remote from industrial centers. Other natural radionuclides, ^{210}Pb, ^{210}Po, thorium, and uranium are also discussed. The results of studies on temporal changes and geographical distribution of some of these contaminants are presented in relation to sources of emission and meteorological factors. The possible increase of the radiation dose to the population from these nuclides is discussed, comparing it to the exposure resulting from the operation of nuclear power plants. The results of the study on the release to the environment of cadmium, vanadium, and lead by fossil-fuel power production are also presented. (auth)

Radioactivity Monitoring and Transport

Refer also to abstracts 13633, 13643, 13999, 14000, 14096, 14102–14104, 14106, 14155, 14156, 14162, 14357, 14421, 15805, 15807, and 15848.

14015 (BNWL-B-384) SUMMARY OF SELECTED AEC CONTRACTORS ENVIRONMENTAL SURVEILLANCE TECHNIQUES AND CAPABILITIES. Denham, D. H.; Waite, D. A.; Corley, J. P. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Sep 1974. Contract AT(45-1)-1830. 44p. Dep. NTIS $5.45.

The radiological environmental surveillance procedures used at 19 major AEC contractor sites, including 8 uranium and transuranium facilities, 6 major production and research facilities, 6 research reactors, 3 nuclear research facilities, and 2 power reactors, were reviewed. A wide variation was observed in the types, capabilities, and radiological evaluation techniques currently practiced for routine environmental surveillance. No glaring deficiencies were noted at any of the sites visited. However, the fact that variation from site to site in sampling, analysis, and data handling was the rule rather than the exception, indicates the need for definitive performance criteria. These criteria should provide a sound basis to define the specific rationale for media, location, and frequency; for minimum acceptable detection limits; and for data handling and reporting. Specific items requiring further research or study are listed. (auth)

14016 (CONF-740115-) PLUTONIUM INFORMATION MEETING, LOS ALAMOS, NEW MEXICO, JANUARY 4–5, 1974. (USAEC Advisory Committee on Reactor Safeguards, Washington, D. C.). Dec 1974. 108p. Dep. NTIS $5.45.

Separate abstracts were prepared for the nine papers included. (CH)

For abstracts of individual papers see: 13772, 13773, 14017, 14018, 14342, 14402, 14403, 14412, and 14413.

14017 (CONF-740115-, pp 16-29) RELEASE OF PLUTONIUM TO THE ATMOSPHERE. Jordan, H. S. (Los Alamos Scientific Lab., NM). Dec 1974.

From plutonium information meeting; Los Alamos, New Mexico, USA (4 Jan 1974).

In plutonium information meeting.

Factors to be considered in recommending maximum permissible inhalation intake values for Pu for personnel and the general public are discussed. Present values for maximum permissible content in air and water of ^{239}Pu in both soluble and insoluble form are included. The difficulties in sampling Pu in the environment and the limitations of air samplers are reviewed. It is pointed out that following an incident resulting in release of Pu to the atmosphere both acute exposure while the cloud is passing and chronic exposure resulting from deposition on surfaces and possible resuspension, especially following deposition on soil, must be considered. Data are summarized for all known accidents (including explosions, fires, snap battery testing, and the detonation of nuclear weapons) that resulted in the release of Pu isotopes to the environment. Results of radiation monitoring of the environs are included. Decontamination used when the accident resulted in surface contamination are described. Values are suggested for interim standards for Pu content in soils and dose limits for both personnel and the general public. (CH)

14018 (CONF-740115-, pp 64-71) BEHAVIOR OF PLUTONIUM IN THE ENVIRONMENT. Hanson, W. C. (Los Alamos Scientific Lab., NM). Dec 1974.

From plutonium information meeting; Los Alamos, New Mexico, USA (4 Jan 1974).

In plutonium information meeting.

Data available on the behavior of Pu in the environment are reviewed. Once into the environment Pu is subject to a variety of factors that modify its behavior in terms of concentration and/or discrimination within ecosystem components. The contamination of large land areas within significant quantities of Pu in the past has usually been by controlled releases of treated radioactive wastes, as in the canyon ecosystems at Los Alamos; nuclear weapons tests, such as the Trinity Site in central New Mexico and the Nevada Test Site; or nonnuclear detonation of nuclear weapons, such as occurred at Palomares and Thule. Most of our knowledge of characteristic Pu behavior in the atmosphere has come from plutonium isotopes that were injected into the stratosphere as a result of atmospheric nuclear weapons tests. Another source resulted from the reentry and burnup of the SNAP-9A power generator during April 1964. Both of these major sources have been closely studied and results indicated that the ratio of ^{239}Pu to ^{90}Sr produced by nuclear weapons testing in the atmosphere essentially remained constant at about 2%. Such estimates showed that, of the 0.4 MCi of Pu produced by nuclear weapons testing through 1962, more than 98% had been deposited by 1965. About 0.3 MCi had been deposited as worldwide fallout, and the remaining 0.1 MCi was locally deposited at the test sites. Latitudinal distribution was closely correlated with rainfall belts at 40 to 60° north latitude and 30 to 50° south latitude, and 80% of the total deposition occurred in the Northern Hemisphere, where most of the Pu had been injected into the stratosphere. Plutonium-238 from weapons tests represented about 0.024 of the total plutonium in soils collected at various worldwide locations prior to the fallout from the SNAP-9A device, compared to a ratio of about 3% for $^{238}Pu/^{239}Pu$ which is characteristic of most nuclear weapons test debris. The SNAP-9A ^{238}Pu had an entirely different distribution pattern, principally because of its injection into the Southern Hemisphere. Stratospheric inventories indicated that, by mid-1970, 95% of this debris was deposited on the earth's surface. Over 75% of it was in the Southern Hemisphere, compared to only 20% of the total weapons ^{238}Pu fallout that occurred in that hemisphere. Interception of atmospheric Pu by vegetation is one means of biological transport that has been shown to depend on local fallout phenomena and physiognomy of the vegetation. Plutonium concentration in trees of an eastern forest was reported to be 16 to 100% more than that on adjacent pastureland plants. And Pu deposition on lichen communities of the Thule, Greenland, area was more efficient per centimeter of precipitation than deposition on lichen communities of northern Alaska. The uptake and transport of Pu by wild animals also occurs. Soil characteristics have an important influence upon Pu movement. One of the most important and most controversial aspects of Pu in soils is the phenomenon of resuspension, defined by Langham as the ratio of the air concentration of plutonium (in micrograms of plutonium per cubic meter) to the surface deposition (in micrograms of plutonium per square meter) below the air mass. (CH)

14019 (STI/PUB-353(Vol.1)) ENVIRONMENTAL SURVEILLANCE AROUND NUCLEAR INSTALLATIONS. Volume I.

Proceedings Series. Proceedings of a Symposium Held in Warsaw, Poland, November 5–9, 1973. (International Atomic Energy Agency, Vienna (Austria)). Aug 1974. 480p. (In several languages). (CONF-731117-(P1)). IAEA $23.00.

Separate abstracts were prepared for the 35 papers included. (CH)

For abstracts of individual papers see: 13643, 13816, 14014, 14021–14029, 14060–14064, 14073–14075, 14081, 14082, 14102–14106, 14115, 14155, 14156, 14420, 14421, 15745, 15746, and 15807.

14020 (STI/PUB-353(Vol.2)) ENVIRONMENTAL SURVEILLANCE AROUND NUCLEAR INSTALLATIONS. Volume II. Proceedings Series. Proceedings of a Symposium Held in Warsaw, Poland, November 5–9, 1973. (International Atomic Energy Agency, Vienna (Austria)). Sep 1974. 465p. (In Several Languages). (CONF-731117-(P2)). IAEA $23.00.

Separate abstracts were prepared for the 29 papers included. (CH)

For abstracts of individual papers see: 13945, 14030–14049, 14068, 14069, 14077, 14078, 14118, 14178, 14357, and 14441.

14021 OBJECTIVES AND REQUIREMENTS FOR ENVIRONMENTAL SURVEILLANCE AT USAEC FACILITIES. Biles, M. B.; Tiernan, M. W.; Schoen, A.; Welty, C. G. (Atomic Energy Commission, Washington, DC). pp 19–33 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); CONF-731117-(P1).

All USAEC facilities which have a significant potential for affecting the environment or which release significant quantities of pollutants are required to conduct a routine environmental surveillance program. Such surveillance is necessary to verify that containment systems, operational controls, and waste disposal practices intended to minimize the release of radioactivity and non-radioactive pollutants to the environment are functioning as planned. The basic objectives of the program are to determine the adequacy and effectiveness of effluent treatment and control, to determine compliance with applicable standards for the control of effluents and protection of the environment, and to establish a normal operational base-line against which the impact of non-routine releases can be monitored and assessed. New facilities are required to conduct surveys prior to start-up to characterize background levels of radioactivity, non-radioactive pollutants, toxic materials and other environmental parameters, and to identify potential pathways for human exposure and/or environmental stress as a basis for determining the nature and extent of the routine environmental surveillance program to be implemented subsequently. Existing facilities are required to conduct a routine program to determine the levels of radioactivity and non-radioactive pollutants in the environment as a result of plant operations, and to evaluate the environmental impact of any releases in relation to applicable standards. A summary of the results of the environmental surveillance programs in the vicinity of major USAEC installations throughout the United States of America is also discussed, including assessments of environmental impact, and the experience obtained with these programs. (auth)

14022 ANALYSIS OF GUIDING PRINCIPLES FOR ENVIRONMENTAL SURVEILLANCE PROGRAMS. Bresson, G.; Coulon, R. (CEA, Fontenay-aux-Roses, France). pp 35–46 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974). (In French).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); CONF-731117-(P1).

The guiding principles for the establishment of environmental surveillance programs must be based on statutory, technical, economic, and social criteria. Highly elaborate rules have been established in most countries, as well as at the international level. Designed to meet the specific problems that are likely to arise in each case, these rules must nevertheless fit into a more general framework, a framework that in some cases can be found ready-made in existing legislation. As regards the technical foundations, it seems essential to get away from the fixed idea of radiological harm and to consider as a whole all the consequences likely to result from the operation of an installation, including in one's study only the most characteristic elements. In an analysis of this kind one will necessarily consider problems relating to the installation itself, to the site, and more generally to the environment around the installation. The economic aspects have already been well illuminated, in particular through cost/benefit analyses. It remains important, however, to analyze certain specific ideas, such as the impact of protection measures on costs (by comparison with competing energy sources) and even certain more abstract concepts, such as the growth of human prosperity. These problems inevitably arise in society as a whole, especially in view of the growing constraints to which society is subjected by virtue of the process of development itself. (auth)

14023 PRINCIPLES AND PRACTICE OF ENVIRONMENTAL MONITORING IN THE UNITED KINGDOM. Mitchell, N. T. (Ministry of Agriculture, Fisheries and Food, Lowestoft, Eng.); Dunster, H. J.; Kenny, A. W.; Birse, E. A. B. pp 47–59 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); CONF-731117-(P1).

Environmental monitoring is an essential feature of the control system for radioactive waste disposal in the United Kingdom. Current procedures, the result of more than 25 years' experience, relate primarily to the nuclear power program as the major source of radioactive waste requiring disposal. The paper outlines the basis of environmental monitoring and the relative roles of central government departments who set the controls, and operators of the sites from which the disposals are made. It goes on to discuss the objectives of programs. The primary objective is in two parts. The first part is the assessment of public radiation exposure; the second part is to provide a check on the adequacy of control measurements. A further and important objective is research, much of it aimed at providing a feedback of information into the control system, and a third objective is the maintenance of good public relations. The paper shows how environmental monitoring programs are designed to meet defined objectives. Mention is made of the part played by environmental modelling techniques in both the design and the interpretation of programs. The functions and value of derived working limits and investigation levels are indicated. The paper concludes with an account of how the principles work out in practice with examples drawn from the nuclear industry. The extent to which purposeful monitoring is required varies widely between sites and between types of waste, the main emphasis being on liquid wastes, with little on surveillance of gaseous releases, and almost none in respect of solid materials. (auth)

14024 ENVIRONMENTAL RADIOACTIVITY SURVEILLANCE METHODS FOR A NUCLEAR FACILITY. Sedlet, J. (Argonne National Lab., IL). pp 139–153 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); CONF-731117-(P1).

The program and techniques used at Argonne National Laboratory for environmental radioactivity surveillance are discussed. The nature of the nuclear studies at Argonne has required monitoring programs for reactors, nuclear fuel fabrication and processing, and general chemical, biological and physical research with a variety of radioactive nuclides. Emphasis is placed on the increased sensitivity and selectivity that have evolved as the techniques of low-level radioactivity measurements have advanced and as the interest in environmental pollution has increased. It appears that as improvements have been made in detection and measurement methods, the increased concern for the environment has required their prompt application. Methods are described for the determination of total alpha, beta and gamma activities; actinide elements, including thorium, uranium, and plutonium; tritium; argon-41; a number of fission products; and other radionuclides in various environmental materials, and for external penetrating radiation. Earlier in the program it was necessary to distinguish between environmental radioactivity from nuclear test fallout and from Argonne. It is now necessary to distinguish between radioactivity from several sources and nuclear installations, and at locations distant from Argonne, for dose evaluation purposes. This is a more difficult problem, and the techniques used for this purpose are discussed. They have required a compromise between monitoring where the origin and level of the radioactivity can be readily established and monitoring as close to man as possible for the most accurate dose assessment. A summary is given of the significant results obtained from the Argonne program, and this type of surveillance is discussed in terms of its application to future monitoring needs, wherein the emphasis will be on dose to humans rather than environmental concentrations. The need to obtain dose values will strain our knowledge of the behavior of radioactive nuclides in the environment and will indicate future information needs and research problems. This work was performed under the auspices of the USAEC. (auth)

14025 DETAILED MEASUREMENT OF ^{131}I IN AIR, VEGETATION, AND MILK AROUND THREE OPERATING REACTOR

SITES. Weiss, B. H. (Atomic Energy Commission, Washington, DC); Voilleque, P. G.; Keller, J. H.; Kahn, B.; Krieger, H. L.; Martin, A.; Phillips, C. R. pp 169-190 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); CONF-731117-(P1).

Recent USAEC studies at several boiling water reactors showed that an average of only 5% of the ^{131}I in the off-gas was in elemental form, while the ^{131}I in ventilation exhaust air averaged 55% elemental. The effect and fate of organic iodide species in the environment around an operating reactor have not been extensively studied. A field program was organized by the USAEC and the Environmental Protection Agency at three reactor sites to study the air → grass → cow → milk portion of the food chain. Three utility companies were involved, and several laboratories participated in sample analyses. Methods were utilized which achieved minimum detectable concentrations of 1×10^{-15} μCi/cm^3 in air, 0.1 pCi/litre in milk, and 50 pCi/kg(dry) in grass. The general approach was to determine the relationships of ^{131}I concentrations among the various media and to relate these to the releases from the nuclear power plants. Of particular importance were the relationships between the average concentration of iodine in air and those in grass and in milk. In addition, an attempt was made to differentiate between elemental and other species of iodine in ambient air. The ^{131}I effluent release rates were measured in terms of iodine species and compared with previous measurements. Activities were not generally observable in vegetation; measured milk concentrations appeared to be directly related to rainfall at the pasture locations. Maximum air-to-vegetation transfer velocities of 2×10^{-2} to 3×10^{-3} m/s were calculated using measured air concentrations and the upper limit vegetation concentrations. Two milk to vegetation transfer parameters were determined from the measurements of ^{131}I in milk and in pasture vegetation. (auth)

14026 ANALYTICAL STUDY OF THE ENVIRONMENTAL SURVEY METHODS IN USE AROUND NUCLEAR INSTALLATIONS IN THE COUNTRIES OF THE EUROPEAN COMMUNITY IN 1971. Recht, P. (EURATOM, Luxembourg); Smeets, J.; Amavis, R.; Cigna, A. A. pp 199-224 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); CONF-731117-(P1).

In 1971 the Public Health Directorate of the European Commission made an investigation in the six member states of the European Communities concerning the environmental survey methods in use around nuclear installations and nuclear power plants, in addition to research centers and others. The aim of this study was to establish the state of the art in this field (the release of radioactive effluents in relation to the factual environmental monitoring programs) from the qualitative and the quantitative points of view, and the principles on which such programs are based. The results of this study are to serve for mutual exchange of information in order to promote the rationalization of methods on the basis of the experience gained in the different countries. Besides such a rationalization, a harmonization of the monitoring programs at the Community level could be considered in the light of the generally accepted Community norms for the protection of man and his environment. Depending on the type of installation and the site, information was collected giving the characteristics of the inputs into the environment by the installations (their nature, composition, quantity, concentration, etc.), the conditions of the release (direct, indirect, continuous, discontinuous, sampling during release, etc.) and the monitoring programs at the point of release (continuous, discontinuous, type of apparatus, etc.) and in the environment (water, ambient air, foodstuffs, etc.). The results of this enquiry are presented and discussed. They show a great diversity regarding the characteristics of the effluents and the survey methods in use, even for similar installations. (auth)

14027 PRACTICAL REFERENCE LEVELS FOR RADIOACTIVE CONTAMINATION IN ENVIRONMENTAL SURVEILLANCE. Boeri, G.; Brofferio, C. (CNEN, Rome). pp 257-267 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); CONF-731117-(P1).

A method of defining practical reference levels of radioactive contamination in environmental samples collected for surveillance purposes around nuclear sites is described. The method makes use of the environmental radiological capacity concept and therefore takes into account the site characteristics defined from ecological studies. Such levels may be defined for each step of any critical exposure pathway but, for practical use, it is suggested that only the most meaningful values be retained. It is shown that the derivation of these levels can be made taking into account, for a particular nuclide, both the environmental capacity and the sensitivity of the method used to measure the contamination level. A series of contamination levels can thus be defined for each site; they may act as a reference of radioactive contamination for that particular environment. Some applications of this method to Italian sites, including nuclear power plants, fuel element processing plants, and research facilities, are discussed. (auth)

14028 EARLY SURVEILLANCE AROUND COASTAL NUCLEAR INSTALLATIONS. Folsom, T. R.; Hodge, V. F. (Scripps Institution of Oceanography, La Jolla, CA). pp 289-299 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); CONF-731117-(P1).

Several biological systems have been used to detect extremely small amounts of radioactivity emanating from nuclear reactors that discharge directly into marine environments. Special attention has been given to Pu. Inorganic absorbing systems, including certain ferrocyanides, provide convenient and sensitive means for monitoring ^{134}Cs and ^{137}Cs in sea water. These may well be used for monitoring automatically. Generally, the absolute concentrations of radiocesium can be determined by comparisons with the concentrations of the natural nuclide, cesium-133, that is present in the marine environment at a level that frequently may be predicted. Selected plants have been found most useful, when samplings are normalized against surface area. Certain brown algae are useful for monitoring Pu, especially nuclide ratios. Silver and cobalt nuclides (^{106m}Ag, ^{110m}Ag, ^{58}Co, ^{60}Co) accumulate preferentially in red algae and marine grasses. Surveillance by means of marine animals is sometimes more sensitive, but proper sampling and interpretations are much more difficult. Several of the common molluscs may be used effectively as monitors of cobalt, silver and other nuclides. Larger fish, whenever their exposure pattern can be estimated, may be exploited for monitoring various metal nuclides through the use of selected organs. Marine biological systems are frequently such sensitive indicators that account must be made of contributions from many sources, even from global fallout more than ten years old. Successful biological surveillance of a given nuclear installation generally requires comparisons of nuclide ratios at several distances using consistent tissues at consistent seasons. (auth)

14029 ANALYTICAL QUALITY CONTROL AND INFORMATION VALUE OF RESULTS IN ENVIRONMENTAL ANALYSIS. Beyer, D. (Kernforschungsanlage, Juelich, Ger.); Merten, D.; Heinonen, J. pp 449-455 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); CONF-731117-(P1).

The results of analytical operations in environmental studies are the basis for far reaching decisions, for example as to protective and remedial measures to be taken. The information value of such data, therefore, has to be clearly indicated. The information value depends on the analytical reliability, the representativeness of samples and specific biological and other properties of the matrix involved. The analytical reliability of the results has to be characterized by stating the precision, accuracy, and detection limits (where appropriate). Suitable methods for its determination are established in the paper. Analytical quality control measures have to be standardized with respect to the method applied and frequency of application, while taking into account acceptable tolerances of the analytical reliability and inherent restrictions due to the specific system. The representativeness of samples is characterized by the Operations Characteristic (OC) of the sampling scheme. The OC specifies the probable error due to sampling. The sampling schemes have to be standardized with respect to frequency of sampling and number of samples to be taken in a certain area, taking into account the acceptable tolerances of the sampling error. The biological properties of the matrices involved, such as biological half-life, organ function, or composition of food, may influence the information value. As they may vary considerably from object to object and region to region, the various deviations from the average have to be stated together with the results in order to enable a correct interpretation to be made. The information value depends on a number of factors, different in nature and magnitude. The achievement of a reasonable information value, therefore, requires an optimization of all procedures involved, taking into account the inherent natural limitations. An optimiza-

tion could be based on a systems analysis, which reveals information on elements, relations, organization, and structure of the system. (auth)

14030 ENVIRONMENTAL LEVELS OF ^{129}I. Matuszek, J. M.; Daly, J. C.; Goodyear, S.; Paperiello, C. J.; Gabay, J. J. (New York State Dept. of Health, Albany). pp 3-20 of Environmental Surveillance Around Nuclear Installations. Vol. II. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol.2); CONF-731117-(P2).

Until recently, ^{129}I releases to the environment have not been considered a serious problem by the nuclear industry. The environmental safety analyses for all private nuclear power facilities presently operating in the United States of America limit the halogen gas-effluent releases only for ^{131}I concentration. Controls for ^{129}I releases are not included in the Technical Specifications. Data collected since 1969 by the New York State Departments of Health and Environmental Conservation indicated significant concentrations of ^{129}I in deer, bovine, and small animal thyroids collected from the environs of a fuel reprocessing facility in New York State. Animal thyroid levels ranged up to 3700 pCi/g tissue. Surveillance for ^{129}I in milk was begun in September 1971. The levels in milk samples collected from holding tanks of individual dairy herds surrounding the nuclear fuel reprocessing plant were as high as 2.3 pCi/litre. The milk levels decreased in the spring, apparently because the cattle were shifted from contaminated feed to open pasture. Water samples collected off site since June 1971 from streams draining the reprocessing plant site showed ^{129}I concentrations up to 8.3 pCi/litre. The long half-life (17 million years) for ^{129}I causes any release to become a permanent biospheric contaminant, permitting wide-ranging contamination of many food products. Milk products, such as condensed milk or formula preparations for infants, would be of special concern, since ^{129}I levels would not be reduced by physical decay and may actually be increased by milk processing operations. Micro-dosimetric calculations based on the high-LET emissions in ^{129}I decay result in dose estimates as high as 800 mrem/a at the cell/colloid interface of an infant thyroid were the child to consume milk at the observed concentrations. Estimates of the dose to human thyroid based on ^{129}I activity levels equivalent to those found in animal thyroids would result in values up to 6300 mrem/a at the cell/colloid interface. Activity levels of ^{129}I in fish flesh indicate that the fish → man pathway could prove dose-limiting. Recommendations are offered for reducing the potential public health hazard. (auth)

14031 NATURAL IODINE AND ^{129}I IN MAMMALIAN THYROIDS AND ENVIRONMENTAL SAMPLES TAKEN FROM SITES IN THE USA. Brauer, F. P.; Soldat, J. K.; Tenny, H.; Strebin, R. S. Jr. (Battelle Pacific Northwest Labs., Richland, WA). pp 43-46 of Environmental Surveillance Around Nuclear Installations. Vol. II. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol.2); CONF-731117-(P2).

Iodine-129 is present in the environment from natural and man-made sources. It is produced by spontaneous fission of natural uranium and spallation reactions in the upper atmosphere. It is also one of the fission products found in the fall-out of debris from nuclear tests. As a fission product, ^{129}I is also produced in nuclear reactors and can be released either at the reactor or later at the irradiated fuels reprocessing plant. Because of its long half-life (1.6×10^7 years), ^{129}I is an excellent tracer for environmental processes involving other stable or radioactive isotopes of iodine. Environmental concentration measurements of stable natural iodine (^{127}I) and long-lived radioactive iodine (^{129}I) were made. Bovine and other mammalian thyroids, air, precipitation, water, grass and milk samples from selected locations were analyzed for their natural iodine and iodine-129 contents. Particle filters and activated charcoal beds were used to collect the particulate and gaseous iodine fractions from the air. Anion exchange was used for the separation of iodine from liquid samples. Combustion methods were used for iodine separation from solid samples, anion exchange resins, and air filters. Iodine-129 and natural iodine concentrations were determined by neutron activation analysis with a detection limit of about 10^6 atoms of iodine-129 per sample. Analytical results of both ^{129}I concentrations and ratios of atoms of ^{129}I per atom of ^{127}I for these samples are summarized. The small radiation doses to human thyroids projected from these low ^{129}I concentrations are also discussed. (auth)

14032 PLUTONIUM BEHAVIOR IN THE TERRESTRIAL ENVIRONS OF THE ROCKY FLATS INSTALLATION. Whicker, F. W.; Little, C. A.; Winsor, T. F. (Colorado State Univ., Fort Collins). pp 89-103 of Environmental Surveillance Around Nuclear Installations. Vol. II. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol.2); CONF-731117-(P2).

Dow Chemical Corporation's Rocky Flats installation, located between Denver and Boulder, Colorado, processes large quantities of plutonium for the USAEC. Storage barrel leakage was a major incident, which resulted in detectable plutonium contamination of air, soil, and biota within and around the plant boundaries. Commercial and residential land development is rapidly approaching the plant from several directions, and this, coupled with increased public concern over environmental contamination, led to considerable controversy concerning radiation protection guidelines, such as permissible levels of ^{239}Pu in soil for various classes of land use. Radioecological studies designed to elucidate existing patterns of plutonium concentration in terrestrial ecosystems surrounding the plant and to define transport pathways, mechanisms, and appropriate intercompartmental rate constants are being initiated by the Department of Radiology and Radiation Biology at Colorado State University under support from the Division of Biomedical and Environmental Research, USAEC. Intensive sampling of soil, litter, vegetation, arthropods, small and large wild mammals, reptiles, and amphibians is being conducted for $^{239,240}Pu$ assay within an area known to be contaminated, and also within a relatively uncontaminated control area nearby. Ancillary field and laboratory experiments are being planned and conducted to isolate the relative importance of transport pathways and to provide quantitative evaluations of plutonium intake and loss rates by specific biotic and abiotic compartments. From such information, an ecosystem model of plutonium transport will be developed for conceptual and predictive purposes. Such a model will be useful in designing future plutonium surveillance programs to achieve maximum information per unit effort. The research approach, findings to date, and methods of plutonium surveillance in terrestrial ecosystems are discussed. (auth)

14033 USE OF BIOLOGICAL INDICATORS FOR ENVIRONMENTAL MONITORING IN THE VICINITY OF NUCLEAR FACILITIES. Kirchmann, R.; Lambinon, J.; Bonnijns-Van Gelder, E.; Colard, J. (CEN, Mol, Belgium). pp 105-118 of Environmental Surveillance Around Nuclear Installations. Vol. II. Vienna; International Atomic Energy Agency (1974). (In French).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol.2); CONF-731117-(P2).

The origins and characteristics of the principal radionuclides present in the environment are referred to briefly. In view of their important role in the transfer of contamination within the biological chain, plants can serve as indicators of radioactive pollution of the biosphere. For purposes of radiological surveillance, certain aquatic mosses (especially Cinclidotus danubicus) proved to be the most suitable indicators for the principal radionuclides discharged in effluent (^{54}Mn, ^{58}Co, ^{60}Co) from a 900 MW(th) PWR into a watercourse. The results of observations covering a period of several years are presented. The possibility of using filamentary algae for the radiological monitoring of still waters (canals) is discussed. As regards the monitoring of atmospheric radioactivity, the use of epiphytes is being investigated; the ability of two lichen species (Evernia prunastri and Hypogymnia physodes) to retain certain fission products is compared with that of other plants or organs. The importance of plant indicators with respect to certain aquatic animals and to sediments is emphasized. (auth)

14034 STUDIES ON THE REMOVAL OF ^{90}Sr, ^{106}Ru, ^{137}Cs, AND ^{144}Ce ON LAND AND IN FRESH WATER. Kamada, H.; Yukawa, M.; Saiki, M. (National Inst. of Radiological Sciences, Chiba, Japan). pp 137-146 of Environmental Surveillance Around Nuclear Installations. Vol. II. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol.2); CONF-731117-(P2).

In order to establish an environmental surveillance program, radionuclide concentrations in soil, river water, water suspension, and sediment were observed. The transfer of radionuclides on land and in fresh water, including a correlation of the radionuclide concentrations between these, is given quantitatively. The equation for removal of ^{90}Sr from land to a river was obtained from radioactivity and hydrometeorological data for the period 1962 to 1969. The annual amounts discharged from various discharge systems were obtained using the equation and measured data. ^{106}Ru, ^{137}Cs, and ^{144}Ce were also studied and compared with ^{90}Sr results. The other equations were determined using regression analysis on the

relationship between ratio of any radionuclide to ^{90}Sr in soil and that in river water with suspension, between soil and that in river-bottom sediment, and also between the radionuclide concentrations in river water and the amount of suspension in the water as given by the radioactivity field survey. The data show that considerable amounts of these radionuclides were precipitated onto the river bottom in an order that can be described as: $^{106}Ru > ^{144}Ce > ^{137}Cs > ^{90}Sr$. The decontamination rates of those radionuclides in drinking water were found to be: ^{106}Ru 50%; ^{144}Ce 48%; ^{137}Cs 31%; and ^{90}Sr 15% (average values). An equation giving the correlation between the decontamination rate and the amount of suspension in the water was obtained. (auth)

14035 TRANSPORT OF TRITIUM IN AN AGRICULTURAL ENVIRONMENT IN MEXICO: STUDY PROGRAM OF CONTAMINATION WITH TRITIUM IN AN AGRICULTURAL AREA. Ortiz Magana, J. R.; Romero, S. F.; Archundia, C.; de Bravo, G. S.; de Nulman, R. M.; Anaya, C. (Instituto Nacional de Energia Nuclear, Mexico City). pp 147-166 of Environmental Surveillance Around Nuclear Installations. Vol. II. Vienna; International Atomic Energy Agency (1974). (In Spanish).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol.2); CONF-731117-(P2).

A study is due to begin in Mexico to determine the movement of tritium in the environment. A controlled area was selected at the Chapingo National School of Agriculture, the characteristics of which are similar to those prevailing in the agricultural zones of the Mexican Plateau. It is intended to reproduce the conditions and farming methods, including sowing and harvesting, prevailing in the zones in question, particularly with respect to the cultivation of maize and beans, which are the principal commodities involved and constitute the basic diet of the Mexican people. Included are studies of the area selected and preparation of equipment and methods for obtaining samples and for the analysis thereof with a view to determining free or bound tritium throughout the ecosystem: For example, information is required on the relative humidity, land from which water may be taken at different depths for economic uses without having a disturbing effect on the ecosystem, plants (root, stem, leaves and flowers or fruit), weeds and plant pests. The first tests and the preliminary results thereof are reported. A detailed description is given of the area chosen, and of the methods of sampling and analysis used. Special emphasis is placed on the experience obtained from and the advantages presented at a meeting of experts of the different disciplines involved, the group having the common aim of solving the problems which arise in a project of this type. (auth)

14036 TWELVE YEARS OF ENVIRONMENTAL MONITORING EXPERIENCE AT THE CADARACHE CENTER FOR NUCLEAR STUDIES. Grandin, M.; Roux, R. (CEN de Cadarache, St-Paul-lez-Durance, France). pp 207-218 of Environmental Surveillance Around Nuclear Installations. Vol. II. Vienna; International Atomic Energy Agency (1974). (In French).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol.2); CONF-731117-(P2).

Observations are presented that are drawn from the day-to-day experience of the radiation monitoring group at the Cadarache Centre for Nuclear Studies. The approach to monitoring, the programs, methods, equipment and training of staff, depend on many factors, including the geographical features of the site, pedological and geological structures, the use made of water, local meteorology, the distribution of the population in the vicinity, the manner in which the laws are applied, and the nature and size of the nuclear facility. Drawing from the experience of the twelve years since the Centre was set up (1961 to 1973), the authors describe some characteristic examples of the development of monitoring and explain how these various factors were taken into account, either on the basis of an a priori approach or under the pressure of operating requirements. What is involved is in fact a process of adjustment to the problems that have arisen (and which will continue to arise) by the team responsible for solving them. After a brief discussion of the site and facilities, the material and (where applicable) human aspects of a certain number of difficulties encountered, the solutions applied, the problems which have been solved, and those still to be overcome are considered. Basically the problems cited relate to the detection of low levels of radioactivity, the effects of environmental radioactivity (natural radioactivity and that due to nuclear tests in the atmosphere), the selection of measures to be taken in case of emergency, effluent disposal procedures, the influence of meteorological factors, data processing, the co-existence of chemical and radioactivity pollution problems, the modification of certain devices, and the training of specialized personnel. (auth)

14037 ENVIRONMENTAL RADIATION SURVEILLANCE AROUND ITALIAN NUCLEAR CENTERS. Fasolo, G. B. (CNEN, Saluggia, Italy); Pirastru, E.; Fraschetti, G.; Frittelli, L.; Tagliati, S. pp 219-237 of Environmental Surveillance Around Nuclear Installations. Vol. II. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol.2); CONF-731117-(P2).

The environmental radiation surveillance program around the CNEN's Italian nuclear centres is based, according to the ICRP Recommendations, on the monitoring of the critical radionuclides in the critical exposure pathways to the critical groups of people, i.e., the groups whose habits, location, or age cause them to receive doses higher than those received by the rest of the population at large. After a brief discussion of the results of the pre-operational investigations and of the operational surveys in the sites, the paper describes the sampling programs and the methods of measuring the collected samples. (auth)

14038 ENVIRONMENTAL SURVEILLANCE AT THE NUCLEAR PHYSICS AND ENGINEERING LABORATORY (SACAVEM): EXPERIENCE ACQUIRED OVER TWELVE YEARS. Ortins de Bettencourt, A.; Severo, A.; Ribau Teixeira, M. M. (Laboratorio de Fisica e Engenharia Nucleares, Sacavem, Portugal). pp 239-250 of Environmental Surveillance Around Nuclear Installations. Vol. II. Vienna; International Atomic Energy Agency (1974). (In French).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol.2); CONF-731117-(P2).

Surveillance of the environment around the Nuclear Physics and Engineering Laboratory at Sacavem has been one of the main concerns of the Radiation Protection Service since the inauguration of this research centre in 1961. Investigations on environmental radioactivity have been rapidly expanded, not only for the purpose of monitoring the environment of the research centre but also for monitoring pollution due to atmospheric fallout. This fallout can often mask contamination accruing from the operation of installations either under normal or emergency conditions, a circumstance which poses problems that are considered in this paper. The authors describe the environmental surveillance program operated by the Nuclear Physics and Engineering Laboratory, record the modifications which have been successively introduced on the basis of experience acquired, discuss the indicators chosen as a basis for monitoring the environment around the centre, namely rain-water, plants, ground dust and dust in suspension, liquid effluents and sediment in the River Tagus, and analyze the trend in the activity of these indicators from 1961 to 1972, dealing in more detail with the results obtained in the last two years. A critical analysis is made of the surveillance program and of the results it has yielded, and the importance of these measures for monitoring a nuclear installation of this type is discussed. (auth)

14039 ENVIRONMENTAL SURVEILLANCE AROUND THE ATOMIC POWER PLANT JASLOVSKE BOHUNICE, CZECHOSLOVAKIA. Carach, J. (Regional Hygiene Station, Bratislava); Csupka, S.; Petrasova, M.; Chorvat, D.; Fojtik, M.; Koprda, V.; Trnovec, T.; Feik, K.; Konecny, J.; Vodrazkova, M. pp 251-262 of Environmental Surveillance Around Nuclear Installations. Vol. II. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol.2); CONF-731117-(P2).

The concept of environmental surveillance as applied at the Jaslovské Bohunice atomic power station is outlined. The results of the pre-operational survey are given and the monitoring programs for control of radioactive gas and liquid effluents are described. The frequency of six meteorological categories at the site is given in relation to the planned releases. The localization of fixed monitoring stations around the plant and the program of the mobile unit are specified. A computer program for rapid evaluation of nuclear accidents has been proposed, and its block diagram and output data are shown. Special attention is paid to tritium and the results of tritium monitoring during the first ten months of operation are reported. (auth)

14040 NATIONAL PROGRAM OF ENVIRONMENTAL SAFETY AT NUCLEAR INSTALLATIONS. Kamath, P. R.; Ganguly, A. K. (Bhabha Atomic Research Centre, Bombay). pp 273-283 of Environmental Surveillance Around Nuclear Installations. Vol. II. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol.2); CONF-731117-(P2).

The paper outlines in brief the comprehensive environmental surveillance programs for radioactive and other pollutants that may be released at sites of nuclear installations in India. The basic safety standards adopted for control are those recommended by the ICRP and the IAEA for radiotoxins and WHO for chemical toxins and public health aspects. Independent surveillance laboratories were set up at Tarapur, Rajasthan, and Madras (nuclear power station sites), at the nuclear fuel fabrication centre at Hyderabad and at Tarapur, and the uranium mining and milling sites in Jadugoda. The problems at each site are characteristic of the operations carried out, and contamination of the environment can result from radioactive and non-radioactive pollutants. The total hazard has to be evaluated and control recommendations are made. A review of the programs confirms that an effective manner of environmental management can be achieved through surveillance and investigations carried out on site. (auth)

14041 RADIOLOGICAL SURVEILLANCE OF THE ENVIRONS AT THE KAHL, GUNDREMMINGEN, LINGEN, AND OBRIGHEIM NUCLEAR POWER STATIONS. Boedege, R. (Kernkraftwerk, Lingen, Ger.); Eickelpasch, N.; Grau, A.; Stephan, W. pp 285-306 of Environmental Surveillance Around Nuclear Installations. Vol. II. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol.2); CONF-731117-(P2).

The programs for radiological surveillance at the Kahl, Gundremmingen, Lingen, and Obrigheim Nuclear Power Stations (Federal Republic of Germany) are described. They are aimed at checking radiation levels, aerosol and iodine activities, contamination and uptakes of radioactivity at selected points at various distances from the emission sources in the environs of the stations. Samples are taken of rain, ground and surface waters, soils, vegetables, cattle feed, milk and other foods, and mud, fishes and plants from the rivers. The releases of all these stations are low compared with the licensed limits, and at no sampling point could deviations from the natural background radiation be recorded. Computations show that the actual dose contribution from direct radiations should be lower than 1 mrem/a. Only a few out of the several hundreds of samples which were taken and measured either in the laboratories of the four stations or in independent laboratories show any values for those radionuclides typical for the releases of the power stations. The results obtained show that, under the past operating conditions, no significant influence on the environment could be observed. On the other hand increases due to fallout from nuclear weapons testing were detected. Some of the requirements for low-level counting and for tracing the origin of certain nuclides when surveying the environment are discussed. It is concluded that the doses to the populations in the environs of the stations are negligibly small (i.e., no additional hazards result from the operation of these four stations), and that most of the measurements conceived before these stations started operation could be dispensed with. Several of the devices (e.g., radiation monitors, dust collectors, iodine filters) may be of use in emergency situations by supplementing those systems especially designed and provided to do field measurements under emergency conditions. (auth)

14042 ENVIRONMENTAL RADIOLOGICAL SURVEILLANCE AROUND UNITED STATES NUCLEAR EXPLOSIVE TESTING SITES. McBride, J. R.; Wruble, D. T. (Environmental Protection Agency, Las Vegas, NV). pp 307-326 of Environmental Surveillance Around Nuclear Installations. Vol. II. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol.2); CONF-731117-(P2).

Experience gained through operation of a comprehensive environmental radiological surveillance program for more than twenty years around United States Nevada Test Site and other nuclear explosive test sites can serve as a guide to such programmes around most nuclear installations. This program, operated by the United States Environmental Protection Agency for the USAEC, has both developmental and operational aspects. The program is designed to provide continuous surveillance of ambient environmental radiation levels during normal operations, and to respond to planned or unexpected releases of radioactivity. Coverage extends from test site boundaries to nearly 1000 kilometres from the site. Continuous and standby air sampling stations for particulate matter and reactive gases are operated through two-thirds of the USA. In addition, continuous noble gas and atmospheric tritium sampling stations are operated near the sites. A milk sampling network is maintained, covering a large portion of the USA. Surface and sub-surface water sources are sampled regularly, and soil, vegetation and food crops are monitored periodically. A network of automatic gamma activity recorders provide continuous exposure rate data. Thermoluminescent dosimeters, worn by members of the general population and placed in a network of fixed locations, provide population and individual dose estimate information. Environmental conditions from below sea level to 3000 metres elevation in mountainous terrain, and from 50°C desert heat to sub-zero alpine conditions are encountered. Normal monitoring and protective action plans responding to releases of radioactivity are carried out with special ground monitoring teams using portable sampling and measuring equipment, and with aircraft equipped to detect and sample airborne radioactive effluents. Planning and implementation of protective action are co-ordinated with various officials and governmental agencies. In the event of population exposures, whole-body counting, automated rapid analysis of environmental samples, and automated data processing are used for exposure assessment. Physicians and veterinarians assist in developing the exposure information. (auth)

14043 ENVIRONMENTAL SURVEILLANCE FOR PLUTONIUM AT THE KARLSRUHE NUCLEAR RESEARCH CENTER FROM 1969 UNTIL 1973. Schuettelkopf, H. (Gesellschaft fuer Kernforschung, Karlsruhe, Ger.). pp 327-344 of Environmental Surveillance Around Nuclear Installations. Vol. II. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol.2); CONF-731117-(P2).

Several nuclear research reactors, a fuel reprocessing plant, an incinerator for radioactive burnable waste and a laboratory for ^{238}Pu production have been operated on the site of the Karlsruhe Nuclear Research Centre, and several institutes there have been concerned with research on transuranium elements. The necessary surveillance of the environment is carried out by analysis for plutonium in plants, precipitation, sediment, plankton and special materials. Nearly 100 samples are collected and analysed each year. The objectives and structure of the surveillance program are described. The analytical results of the last four years are reported. The results of environmental surveillance performed with plants and precipitation, and the different annual variations of plutonium concentrations in these sample materials are compared. The effectiveness of the surveillance system is discussed critically, taking as an example some unplanned releases of plutonium to the environment. (auth)

14044 ENVIRONMENTAL RADIATION MONITORING INSIDE BHABHA ATOMIC RESEARCH CENTER USING THERMOLUMINESCENT DOSIMETERS. Nambi, K. S. V. (Bhabha Atomic Research Centre, Bombay). pp 345-351 of Environmental Surveillance Around Nuclear Installations. Vol. II. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol.2); CONF-731117-(P2).

The Bhabha Atomic Research Centre (BARC) at Trombay is the main centre for atomic research in India. There are a variety of nuclear installations on this site, namely, a 40 MW(th) research reactor, a 300 kW swimming pool reactor, a zero-energy reactor for lattice investigations, a plutonium-fuelled fast critical assembly, a fuel fabrication plant, a fuel reprocessing plant, a thorium plant, a uranium metal plant, a Van de Graaff accelerator, an isotope processing laboratory, and a host of high intensity gamma irradiation facilities. The environs of Bhabha Atomic Research Centre, Trombay, are routinely monitored for the radiation background with the aim of getting advance indication of any trend towards a harmful build-up of the radiation field around the various nuclear facilities. Any routine survey program employing the conventional survey meters does not provide complete information. The cost, however, of installation of automatic, continuous, recording radiation monitors at a number of locations for routine surveillance is indeed prohibitive. Hence a comprehensive TLD survey program, measuring integrated background exposures over a quarterly cycle has been in operation since 1967. Natural fluorite powder forms the radiation detector in this TLD system, which has proved to be very simple, inexpensive and precise for large-scale routine measurements of small, integrated, external-radiation doses. Although CaF_2 has a strong energy dependence and is sensitive to daylight, these problems have been practically circumvented by proper choice of calibration and light-shielding techniques, respectively. The dosimeter is free from any interference resulting from wide temperature and humidity variations. The precision of the TLD system is about 5%, and the minimum detectable integrated gamma dose is about 10 mR. The dosimeters, sealed in light-tight and water-tight casettes, are regularly replaced at about twenty locations inside BARC once every three months, and the integrated quarterly dose recorded by each dosimeter is read out in the laboratory. Results obtained for

the gamma fields at the various positions, averaged over a year for the five-year period, 1968-1972 are presented. Trends due to either increase or decrease in radiation operations at many of the sites are clearly brought out by the TLD readings. Comparison with scintillation/GM survey meter readings taken daily at these locations are also presented. The results clearly indicate the fact that, while the conventional radiation survey programme gives a picture of the transient situation at the time of measurement, the TLD program gives the integrated picture of the background level at the site and is informative for environmental radiation surveillance. (auth)

14045 MONITORING OF EFFLUENT ENTERING THE WINNIPEG RIVER FROM THE WHITESHELL NUCLEAR RESEARCH ESTABLISHMENT IN THE PERIOD 1963–1972. Guthrie, J. E. (Atomic Energy of Canada Ltd., Pinawa, Manitoba); Acres, O. E.; Paul, G. I. pp 353-366 of Environmental Surveillance Around Nuclear Installations. Vol. II. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol.2); CONF-731117-(P2).

A point in time may be reached at which the amounts of radionuclides released to the environment from a nuclear facility are too small for the environmental surveillance programme to provide useful data. The question then arises: could the effort spent on surveillance not be put to better use by increasing the frequency of monitoring? The quantities of fission products released to the Winnipeg River from the Whiteshell Nuclear Research Establishment (WNRE) of Atomic Energy of Canada Ltd. exceed those that would be released to a river from a CANDU-type nuclear power station. Results of water and fish analyses are summarized and the probability of detecting a significant increase in the concentration of radionuclides in the Winnipeg River attributable to WNRE operations, given the current levels due to background and nuclear weapons fallout is examined. The justification for continuing this type of surveillance activity is questioned. It is concluded that the surveillance effort of a CANDU-type nuclear power station operator would be better spent by increasing the frequency of liquid effluent sampling, to reduce to as small as practicable the chance of an undetected escape of effluents that might exceed permissible limits. (auth)

14046 CONTRIBUTION OF FACTORY INSPECTORATE MEASURES TO ENVIRONMENTAL SURVEILLANCE ACTIVITIES AROUND NUCLEAR INSTALLATIONS IN THE STATE OF NORTH RHINE-WESTPHALIA. Erlenbach, H. R. (Factory Inspectorate of the State of North Rhine-Westphalia, Duesseldorf). pp 367-378 of Environmental Surveillance Around Nuclear Installations. Vol. II. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol.2); CONF-731117-(P2).

The present situation and the foreseeable development of nuclear installations in the state of North Rhine-Westphalia, and their effect on the contamination of the Rhine and the Ruhr Rivers, including the operation of nine reactors, are reviewed. The environmental surveillance scheme for radioactive contaminants applicable to the whole of the State, having as its bases the already operating nuclear installations, is expounded. The role played by Factory Inspectorate establishments in this respect is discussed and their monitoring techniques and checking procedures are summarized. A survey and interpretation of results obtained is given. (auth)

14047 METHODS OF CALCULATING THE POPULATION DOSE. Gusev, N. G.; Belyaev, V. A. (Biophysics Inst. of the Ministry of Health, Moscow). pp 379-388 of Environmental Surveillance Around Nuclear Installations. Vol. II. Vienna; International Atomic Energy Agency (1974). (In Russian).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol.2); CONF-731117-(P2).

The paper discusses methods of calculating the radiation dose to the population in the case where radiation factors exert a direct effect on the population living in the area in which the contamination originates, and also in the case of consumption of food products that become contaminated in this area and are then transported to other areas. It also discusses the units in which the population dose is to be measured. Owing to the rapid development of atomic energy, it is economically advantageous for nuclear power stations to be located in thickly populated areas, even within the boundaries of large towns. An urgent problem in this connection is assessing the consequences of exposure of the population to low doses of radiation. If one proceeds on the assumption that there is no threshold for the effect of radiation and that there is a linear dependence between dose and biological effect, the population dose can serve as a direct measure of radiation insult to the public. (auth)

14048 ESTABLISHMENT OF STANDARDS AND OPERATIVE LIMITS FOR RADIOACTIVE CONTAMINANTS. Lindell, B. (Swedish National Inst. of Radiation Protection, Stockholm). pp 391-398 of Environmental Surveillance Around Nuclear Installations. Vol. II. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol.2); CONF-731117-(P2).

A review is given of the basic principles behind the establishment of radiation protection standards for the population, and operative discharge limits for radioactive contaminants. These principles are based upon the system of dose limitation recommended by the International Commission on Radiological Protection, including cost/benefit evaluation both of the radiation sources and of methods and equipment intended for dose limitation. (auth)

14049 ROLES OF EFFLUENT AND ENVIRONMENTAL MONITORING IN SURVEILLANCE OF RADIOACTIVE WASTES RELEASED FROM NUCLEAR INSTALLATIONS. Mitchell, N. T. (Ministry of Agriculture, Fisheries, and Food, Lowestoft, Eng.). pp 399-411 of Environmental Surveillance Around Nuclear Installations. Vol. II. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol.2); CONF-731117-(P2).

Radioactive waste is an inevitable consequence of the operation of nuclear installations. The extent to which disposal needs to be practised varies widely with the nature of the operations involved and the amount of treatment of effluent streams, but it is generally accepted that some waste disposal is a practical necessity. Monitoring procedures, adopted to ensure the safety of such waste disposal operations, fall into two categories: the effluents themselves and the environment to which the effluents are released. Methods of waste disposal control, the role and purpose of effluent monitoring, and the extent to which it can be a means of demonstrating adequate protection of the public are considered. A more direct method of demonstrating the radiological safety of discharges is by monitoring the environment. Objectives of environmental monitoring programs and their design and organization are considered. An account is included of how environmental monitoring is used to estimate public radiation exposure, demonstrating the particular value of the critical path approach. (auth)

Atmosphere

Refer also to abstracts 13998 and 14178.

14050 (BARC-679) MEASUREMENTS ON AIRBORNE AND SURFACE FALLOUT RADIOACTIVITY IN INDIA. Gopalakrishnan, S.; Rangarajan, C.; Joshi, L. U.; Kapoor, D. K.; Eapen, C. D. (Bhabha Atomic Research Centre, Bombay (India)). 1973. 124p. INIS.

Measurements on fission products and other radionuclides carried out since June 1965 in India are presented. The counting and analysis procedures are summarized. Radon–thoron daughter activities are reported as ^{214}Pb (RaB) and ^{212}Pb (Th-B) concentrations. A table is presented with data of the fission product gross beta activity of daily air filter collections at various stations following a few nuclear tests. The dates of arrivals of fresh activity are also indicated in the table. (INIS)

14051 (HASL–288) FALLOUT PROGRAM. Quarterly Summary Report, September 1, 1974–December 1, 1974. Hardy, E. P. Jr. (USAEC Health and Safety Lab., New York). 1 Jan 1975. 172p. Dep. NTIS $7.60.

Current data from the HASL Program are presented. The initial section consists of interpretive reports and notes on the regional uniformity of cumulative radionuclide fallout, analyses of quality control samples at HASL and a contractor laboratory in 1974, and quality control results for the HASL surface air samples in 1973. Subsequent sections include tabulations of radionuclide levels in fallout, surface air, stratospheric air, milk, diet, and tap water. A bibliography of recent publications related to radionuclide studies is also presented. (auth)

14052 (HASL–288(App.)) APPENDIX TO FALLOUT PROGRAM. Quarterly Summary Report, September 1, 1974–December 1, 1974. Hardy, E. P. Jr. (USAEC Health and Safety Lab., New York). 1 Jan 1975. 474p. Dep. NTIS $10.60.

The following tables of current data from the HASL Program are presented: ^{90}Sr and ^{89}Sr in monthly deposition at world land

sites; radionuclides and lead in surface air; radiostrontium in milk and tap water; table of conversion factors; and table of radionuclides. (HLW)

14053 (JPRS-62484) TRANSLATIONS ON ENVIRONMENTAL QUALITY. Number 43. Translated from Various Journals (16 Jul 1974). 47p. NTIS $3.25.

Contents include: air pollution in CSSR described; Venezuela president calls on society to practice conservation; Caracas conference to deal with dangers of further ocean pollution; USSR-US antipollution efforts discussed; Estonian Supreme Soviet inquiries about pollution; World Environmental Protection Day; Moscow meeting on environmental protection; pure water for the Baltic Sea discussed; cleaning up the Volga and Ural rivers; air pollution in capital of Kazakhstan; efforts against air pollution in Alma-Ata; landscaping and planting on Apsheron Peninsula; readers' remarks on noise pollution; industries oppose strict pollution control measure. (GRA)

14054 (NP-20286) RADIOACTIVE EFFLUENTS FROM NUCLEAR POWER STATIONS IN THE COMMUNITY. Discharge Data Radiological Aspects. (Commission of the European Communities, Brussels (Belgium). Directorate for Social Affairs). Apr 1974. 44p. Dep. NTIS (US Sales Only) $5.25.

Data are summarized on the activities of gaseous and liquid waste discharged from nuclear power stations in the Community of Six and those run by the Central Electricity Generating Board in Great Britain during the period 1969 through 1972. The typical composition of radionuclides in the noble gases discharged by the various power stations is given. In the case of liquid effluents, in addition to listing the radionuclides identified in 1972, the report indicates the methods of activity assessment used and also the fraction of the maximum permissible concentration for drinking water reached in the receiving watercourse, as an annual average. On the basis of the discharges made, maximum exposure around the sites was estimated and compared with the dose limits fixed by radiological protection standards and with the natural level of radiation. The ratio of activity discharged (noble gases and liquid effluents excluding tritium) to the energy produced is given for each power station. (auth)

14055 (SCPRI(RM)-3-1974) MONTHLY PROGRESS REPORT. (Service Central de Protection Contre les Rayonnements Ionisants, 78— Le Vesinet (France)). Mar 1974. 17p. (In French). Dep. NTIS (US Sales Only) $4.00.

This monthly report of the SCPRI presents an interpretation of the principal results concerning the surveillance of radioactivity in the environment: atmospheric dusts (air at ground level, high altitude air), rainwater, surface water, underground water, irrigation water, drinking water, food chain (milk, plants, cattle, fish) sea water around nuclear plant sites and other sites. The activities of various radioisotopes are presented in tables (^{7}Be, ^{95}Zr and ^{95}Nb, ^{103}Ru, ^{131}I, ^{137}Cs, ^{140}Ba and ^{140}La, ^{90}Sr, ^{106}Ru and ^{106}Rh, ^{226}Ra, ^{54}Mn, U and T). A monthly bibliographic selection is also presented. (FR)

14056 (SCPRI(RM)-3-1974(App.)) APPENDIX TO THE MONTHLY PROGRESS REPORT: DETAILS OF THE RESULTS OF MEASUREMENTS. (Service Central de Protection contre les Rayonnements Ionisants, 78— Le Vesinet (France)). Mar 1974. 27p. (In French). Dep. NTIS (US Sales Only) $4.50.

Measurement tables concerning the surveillance of the environment (see also the SCPRI-RM-3-7 report) are presented. (FR)

14057 (SCPRI(RM)-4-1974) MONTHLY PROGRESS REPORT. (Service Central de Protection contre les Rayonnements Ionisants, 78— Le Vesinet (France)). Apr 1974. 15p. (In French). Dep. NTIS (US Sales Only) $4.00.

This monthly report of the SCPRI presents an interpretation of the principal results concerning the surveillance of radioactivity in the environment: atmospheric dusts (air at ground level, high altitude air), rainwater, surface water, underground water, irrigation water, drinking water, food chain (milk, plants, cattle, fish), sea water around nuclear plant sites and other sites. The activities of various radioisotopes are presented in tables (^{7}Be, ^{95}Zr and ^{95}Nb, ^{103}Ru, ^{131}I, ^{137}Cs, ^{140}Ba and ^{140}La, ^{90}Sr, ^{106}Ru and ^{106}Rh, ^{226}Ra, ^{54}Mn, U and T). A monthly bibliographic selection is also presented. (FR)

14058 (SCPRI(RM)-4-1974(App.)) APPENDIX TO THE MONTHLY PROGRESS REPORT: DETAILS OF THE RESULTS OF MEASUREMENTS. Service Central de Protection contre les Rayonnements Ionisants, 78— Le Vesinet (France)). Apr 1974. 25p. (In French). Dep. NTIS (US Sales Only) $4.25.

Measurement tables concerning the surveillance of the environment (see also the SCPRI-RM-4-1974 report) are presented. (FR)

14059 (TLW-6100) DETERMINATION OF THE HOMOGENEITY OF NUCLEAR CLOUDS FROM AIRBURSTS. Part I. Final Report. Nathans, M. W. (Trapelo/West, Richmond, Calif. (USA)). May 1971. Contract AT(04-3)-682. 106p. Dep. NTIS $8.50.

A number of cloud samples from Dominic-Yeso and - Questa obtained at different altitudes and at different times after the event were analyzed to obtain the particle size distribution and the specific activity as a function of the particle size. The particle size distributions were, as usual, lognormal. The geometric mean diameters and to a much lesser extent the standard deviations showed variations between samples, that did not correlate with the altitude and time of sampling. The radionuclide specific activities appear to be a unique function of the particle diameter. Consequently there was found, on the basis of limited data, a correlation between radionuclide ratios and the mean diameters of the particle size distributions. The existence of a sharp increase of the specific activity with decreasing particle size was confirmed. Since the measured mean diameters of the particle size distributions were larger by a factor of as much as four than those predicted by theory, some preliminary experiments were conducted with exploding iron wires. The particle size distributions of the debris agreed numerically well with the theory, but the energy dependence could not be ascertained. (auth)

14060 MEASUREMENT OF LOW CONCENTRATIONS OF RADIOACTIVE NOBLE GASES IN EFFLUENTS AND IN THE ATMOSPHERE. Botlino, A. (CSN, Casaccia, Italy); Lembo, G.; Scacco, F.; Sciocchetti, G.; Lasa, J. pp 191-197 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); CONF-731117-(P1).

In the analysis of ^{85}Kr and other radioactive gases present in the atmosphere at low concentrations following release from nuclear reactors preliminary operations are necessary before making measurements using nuclear techniques. In particular, enrichment of the sample and successive purification by eliminating other atmospheric gases are a prerequisite to performing measurements by liquid scintillation counting. The paper describes a new method of gas chromatographic separation of a krypton-enriched sample in a continuous automatic process. (auth)

14061 PERMANENT GAS MEASUREMENTS AS PART OF AN ENVIRONMENTAL SURVEILLANCE PROGRAM. Matuszek, J. M.; Paperiello, C. J.; Kunz, C. O.; Hutchinson, J. A.; Daly, J. C. (New York State Dept. of Health, Albany). pp 225-233 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); CONF-731117-(P1).

In addition to conventional monitoring of the krypton and xenon radioactivity released from nuclear facilities, the Radiological Sciences Laboratory of the New York State Department of Health has been conducting a study of the several permanent gases which are also released. The gaseous effluents from a boiling-water reactor (BWR), two pressurized light-water reactors (PWR), a high-temperature gas-cooled reactor (HTGR) and a pressurized heavy-water research reactor (PHWR) were analyzed for radioactive and stable gas constituents. In the case of the BWR, direct stack sampling has ensured representative sampling. The PWRs, HTGR and PHWR do not provide for direct stack sampling, so analysis of hold-up tank gas, cover gas, primary-coolant strip-gas, and containment air was required to derive characteristic patterns of gas releases from these reactors. Gamma-emitting gaseous species are measured spectrometrically using a Ge(Li) detector. Chromatographic separation of various gas fractions on a series of molecular sieve columns permits the use of internal gas-proportional counting tubes for spectrometric resolution of beta-emitting gas species. In addition to measurement of gamma-emitting noble gases, ^{3}H (as hydrogen gas and methane), ^{14}C (as methane and carbon dioxide), ^{37}Ar and ^{39}Ar have been quantitatively identified. Measurements of radioactive high hydrocarbons, carbon monoxide and methyl iodide in the gaseous effluents are in progress. The Laboratory's experience in collection, handling, and analysis of samples is discussed. Estimates of total annual release of the several species are provided. Relative release rates are compared to control requirements. (auth)

14062 COLLECTION OF SAMPLES AND DETERMINATION OF TRITIUM IN THE LAYER OF AIR NEAR THE EARTH'S SURFACE. Gedeonov, L. I.; Blinov, V. A.; Stelanov, A. V.; Gavrilov, V. M.; Tishkov, V. P.; Maksimova, A. M. (Radium Inst., Leningrad). pp 235-241 of Environmental Surveillance Around Nuclear Installa-

tions. Vol. I. Vienna; International Atomic Energy Agency (1974). (In Russian).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); CONF-731117-(P1).

The development of atomic power requires, along with other types of radiological monitoring, tritium surveillance both in the vicinity of nuclear facilities and at considerable distances from them. A system is described that was developed for sampling atmospheric moisture or unoxidized tritium, converting it to a counter gas for proportional counter measurements and for measuring tritium samples in concentrations of $\geq 10^2$ tritium units (TU). For measurements in the concentration range of 10^2 to 10^6 TU, a proportional counter has been built with setting adjustment based on x-radiation from ^{55}Fe. For the determination of higher concentrations, a liquid-scintillator type of counter suitable for work under field conditions is proposed. (auth)

14063 INTEGRAL DOSIMETER STUDY OF GAMMA-RAY DOSE IN THE VICINITY OF A NUCLEAR REACTOR. Vasilev, G.; Filev, G. (Inst. of Radiobiology and Radiation Hygiene, Sofia). pp 285-288 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); CONF-731117-(P1).

A method of measuring gamma dose due to the release of radioactive inert gases (^{41}Ar, ^{85}Kr, and ^{133}Xe) in the vicinity of a nuclear reactor is described. The method is based on the use of high-sensitivity integral gamma dosimeters. These instruments were developed by combining gamma-ray scintillators with dosimetric photoemulsions. The working principle of the dosimeter and such performance characteristics as sensitivity, relationship between blackening and exposure dose, and efficiency as a function of the gamma-ray energy are discussed. The integral dosimeter was used to study gamma dose distribution in the vicinity of the IRT-2000 research reactor. Radiation conditions around the reactor are analyzed on the basis of gamma background counts made over a number of years. (auth)

14064 INTERPRETATION OF AEROSOL RELEASE MEASUREMENTS AT NUCLEAR POWER PLANTS. Fritze, R. (Technischer Ueberwachungs-Verein Norddeutschland eV, Hamburg); Herrmann, G. pp 413-423 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); CONF-731117-(P1).

Five nuclear power plants were put into operation in the Federal Republic of Germany by 1972, and 15 more are expected to be in operation by 1980. Increasing attention is, therefore, being given to the interpretation and standardization of release measurements, since they provide the most effective means for immediate surveillance of the impact on the environment. Problems mainly connected with aerosol radioactivity are discussed. The licensed release rates for aerosol activity for the five plants lie between 1.2 mCi/h and 1.8 Ci/h. How the release is to be measured is, however, not specified. Commonly, aerosols are collected on a filter in a bypass to the stack and their activity (natural, corrosion and fission products) is measured during collection and after certain decay periods with a β-sensitive counter. The Lingen plant (BWR) and the Stade plant (PWR) are taken as reference plants and release rates of radioactive aerosols and nuclide compositions are reported. The releases from BWRs contain a relatively large fraction of short-lived radionuclides, and weighting the values of the activities released on the basis of the half-lives is possible, if revised release rates are not granted, and a balance is drawn accordingly. For PWRs, it is suggested that the weekly release rates be determined from a sample collected over the period of one week, measuring the β activity at the end of the collecting period. The reasons for and against either γ-monitoring or β-monitoring systems for the measurements made during collection are discussed on the basis of the nuclides that determine the licensed release rate. Both methods can in principle be used. In PWRs it may be advantageous for plant control to use γ spectrometry, as this may give an indication of unexpected releases inside the plant. As a part of the aerosols is lost in the pipe leading from the stack to the monitor, a loss factor has been determined and is discussed. (auth)

14065 ISOTOPE COMPOSITION OF THE MAJOR CONTRIBUTORS TO ATMOSPHERIC SULFUR. Nielsen, H. (Univ., Goettingen, Ger.). Tellus; 26: No. 1-2, 213-221(1974).

Only a few S isotope data from atmospheric precipitates are available. These results demonstrate the possibility to discriminate between sulfur burdens from different natural and/or anthropogenic sources. The $\delta\ ^{34}S$ patterns of the major suppliers of atmospheric sulfur are discussed. Their δ ranges overlap so completely that S isotope data at atmospheric samples cannot be used to calculate the net contribution rates from the individual sources at a global scale. For selected areas, however, such conclusions can frequently be drawn. The most reliable results are to be expected from areas with only two (at maximum three) major sulfur suppliers with well known S isotopic composition and large δ difference between the individual sources. Limitations are given mainly by the complex origin of atmospheric sulfur from a variety of different sources (especially in highly industrial regions) and by the broad δ ranges even in relatively "uniform" suppliers. Furthermore the fate of the sulfur compounds after emission to atmosphere may be quite complex. Additional fractionation processes efface the "fingerprint" character of the S isotope composition. In some cases these difficulties may be overcome, when the S isotope values are correlated with other geochemical data. (auth)

14066 ISOTOPIC STUDIES OF THE SULFUR COMPONENT OF THE STRATOSPHERIC AEROSOL LAYER. Castleman, A. W. Jr.; Munkelwitz, H. R.; Manowitz, B. (Brookhaven National Lab., Upton, NY). Tellus; 26: No. 1-2, 222-234(1974).

From symposium on trace gases; Mainz, Germany (2 Apr 1973).

A major fraction of the large-size population of the Junge aerosol layer is comprised of sulfates thought to be of terrestrial origin. In order to obtain direct evidence concerning the importance of various contributing sulfur sources as well as the significance of in situ gas-to-particle reactions, an extensive study was undertaken of the sulfur concentration and isotopic ratio of particles, collected from 1962 to 1971 in the lower stratosphere over a wide range of latitudes. The data show that the major perturbations to the low-level persistent aerosol layer result from a few explosive volcanic eruptions. The extent of the initial tephra contribution to the layer gradually subsides, but particles are continuously replenished by aerosols formed from the gaseous portion of the eruptions. Trends in $\delta^{34}S$ enrichment following an event are consistent with a simple one-dimensional model accounting for both transport and chemical reaction. During periods of comparative volcanic quiescence, the isotopic ratios of stratospheric sulfates in both hemispheres exhibit a similar value, suggesting continual input from a common equatorial source. (auth)

14067 ISOTOPIC MEASUREMENT OF ATMOSPHERIC NITROGEN COMPOUNDS. Moore, H. (National Center for Atmospheric Research, Boulder, CO). Tellus; 26: No. 1-2, 169-174(1974).

From symposium on trace gases; Mainz, Germany (2 Apr 1973).

A short review of nitrogen isotope studies as related to atmospheric compounds is presented. Methods utilized for the collection and conversion of various nitrogen-containing compounds found in the atmosphere to N_2 suitable for mass spectrometric measurement are described. Preliminary results obtained on the concentration of and $^{15}N/^{14}N$ ratio in N_2 from NH_4^+, NO_3^-, N_2O and NO_2 in air and other samples are given and the results with respect to NH_4^+ and NO_3^- in precipitation are discussed briefly. (auth)

14068 USE OF INORGANIC SORBENTS FOR COLLECTING AND MONITORING RADIOIODINE IN GASEOUS DISCHARGES AND IN THE ENVIRONS OF NUCLEAR POWER PLANTS. Hladky, E.; Pietrik, I.; Moravek, J. (Power Research Inst., Trnava, Czech.). pp 21-29 of Environmental Surveillance Around Nuclear Installations. Vol. II. Vienna; International Atomic Energy Agency (1974). (In Russian).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol.2); CONF-731117-(P2).

For continuous monitoring of the activity of ^{131}I and its compounds in gaseous discharges the authors developed a device based on the continuous sampling of air by a sorbent in a 100 mm dia. × 100 mm scintillator well. The activity of the radioiodine collected is measured by standard electronic apparatus in the 300 to 400 keV energy range. For collection of the iodine they studied two inorganic sorbents: first, alumina (Al_2O_3) saturated with $AgNO_3$ and, second, silicon oxide saturated also with $AgNO_3$. It was concluded that, as far as conventional detection of radioiodine in gaseous discharges of nuclear power stations is concerned, the most suitable material is alumina saturated with $AgNO_3$; this compound is highly effective in trapping not only elemental iodine but also methyl iodide in the case of large flow rates of gas through the sorbent and even at high relative humidity levels. The sorption of gaseous fission fragments (Kr,Xe) is virtually nil. The apparatus described can be used for the detec-

tion of ^{131}I in the gaseous discharges of nuclear power stations, the detection sensitivity being 0.01 to 1.0 curies per litre. (auth)

14069 IS THERE A PLACE FOR PRECIPITATION COLLECTION IN ROUTINE RADIATION SURVEILLANCE. Paul, G. I. (Univ. of Manitoba, Winnipeg); Guthrie, J. E.; Acres, O. E. pp 263-271 of Environmental Surveillance Around Nuclear Installations. Vol. II. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol.2); CONF-731117-(P2).

Measuring the radionuclides deposited by rain and snow offers a simple method for determining the change in surficial radioactivity attributable to fallout from nuclear weapons testing. This technique has also been used for the surveillance of airborne plumes of radioactivity released from a nuclear facility. At Whiteshell Nuclear Research Establishment (WNRE), there are five ambient gamma radiation monitoring stations on the perimeter of the restricted area, each about 2.5 km from the reactor and hot-cell buildings. They are situated according to the directions of the prevailing winds. A sixth (background or reference) station is located at the town of Pinawa, 10 km east of WNRE. Since 1963, monthly rain and snow samples have been collected at each station. After they were counted for total-beta activity and examined by gamma spectrometry, their radiocesium and radiostrontium content was determined using standard radiochemical procedures. Fission products produced by the detonation of nuclear devices were identified. However, no releases to the atmosphere from WNRE were detected. It is shown that the amount of radioactivity still being deposited by nuclear weapon fallout masks all normal, and accidental, airborne releases from WNRE. Therefore, it is concluded that it is preferable to detect radioactive emissions at their points of release, before they enter the environment. The major experimental facilities at WNRE include the WR-1 organic-cooled 60 MW$_t$ research reactor, and hot-cells for the examination of irradiated nuclear fuel. WNRE releases small quantities of activated noble gases and tritium to the atmosphere via the reactor stack. Mixed fission products might also escape to the air through the hot-cells stack. (CH)

Soil

14070 CONTAMINATION OF SOILS BY INDUSTRIAL RADIOACTIVE WASTES. Mechanisms and Factors of Migration and Evolution. Saas, A. (CEN de Cadarache, Saint-Paul-les-Durance, France). Sci. Sol.;No. 4, 255-264(1973). (In French).

A number of examples are given illustrating investigations on soil protection carried out by the laboratory of continental radioecology. The techniques of soil and radionuclide migration are first reviewed. The main trends of investigations are then developed: role of the radionuclide vector in the soils, influence of the mode of entry of the radionuclide in the biological cycles, influence of some specific soils compounds, in particular organic matter. The aim of these applied investigations is to demonstrate the main mechanisms involved in the transfer of radionuclides to the soils and their uptake by plants. (FR)

14071 INFLUENCE OF POTASSIUM, AMMONIUM AND CALCIUM IONS ON THE SORPTION-DESORPTION PATTERNS OF Cs-137 IN VARIOUS SOILS. Smierzchalkska, K. (Polska Akademia Nauk, Warsaw. Rolnicza Pracownia Izotopowa). Pol. J. Soil Sci.; 5: 117-125(1972).

The NH_4^+ and K^+ ions affected most the adsorption of Cs-137 by soils, and their reducing effect took place markedly at increasing concentrations. The NH_4^+ were more effective than the K^+ ions. The Ca^{2+} ions were almost ineffective in the adsorption processes of Cs-137 in heavier types of soils; they were of some small effect in sandy soils at very high concentrations. (auth)

Water

14072 (INS-764, pp 70-71) RADIOACTIVE FALLOUT. Mason, W. J.; Ditchburn, R. G. Apr 1974.

14073 ANALYTICAL SYSTEMS APPLIED TO MONITORING THE AQUATIC ENVIRONMENT IN THE CONTROL OF RADIOACTIVE WASTE DISPOSAL. Dutton, J. W. R.; Mitchell, N. T.; Reynolds, E.; Woolner, L. (Ministry of Agriculture, Fisheries and Food, Lowestoft, Eng.). pp 155-167 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol.1); CONF-731117-(P1).

Monitoring of the aquatic environment is an important part of the work of the Fisheries Radiobiological Laboratory, Lowestoft, in setting controls on liquid radioactive waste disposal. This has created a considerable demand for analytical systems covering a wide range of radionuclides and environmental materials, which, influenced also by the nature of discharges, has led to the adoption of a flexible approach designed to ensure comprehensive surveillance of all the radiologically important contaminants of the environment. The analytical systems in current use are discussed, together with the way in which they are applied in routine operation. In addition to the counting of radioactivity, sample preparation and the processing of counting data, largely achieved by use of digital computers, are also discussed. The range of nuclides requiring analysis covers alpha, beta, gamma and x-ray emitters. Some analysis can be done on a gross basis, especially beta, but most of the samples received are ultimately analyzed for specific constituents. Specific analysis is achieved either utilizing radiometric techniques without further preparation or following separative radiochemistry. Experience has shown that the most valuable tool is gamma spectrometry using NaI(Tl) or Ge(Li) detectors. Most of the radiochemical separations are aimed at beta emitters, but also occasionally at alpha-emitting nuclides and others at low concentrations. This group includes strontium-90, iron-55, cesium-134 and -137, and technetium-99; examples of the methods which have been developed are discussed together with their application to routine monitoring. (auth)

14074 MONITORING LOW-LEVEL RADIOACTIVE AQUEOUS DISCHARGES FROM A NUCLEAR POWER STATION IN A SEA-WATER ENVIRONMENT. Montgomery, D. M.; Krieger, H. L.; Kahn, B. (Environmental Protection Agency, Cincinnati). pp 243-256 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); CONF-731117-(P1).

Methods were developed and tested for measuring ^{54}Mn, ^{58}Co, ^{60}Co, ^{89}Sr, ^{90}Sr, ^{131}I, ^{134}Cs, and ^{137}Cs in relatively large volumes of seawater. These isotopes were found by analysis of low-level radioactive wastes to be the most radiologically significant among those discharged into seawater from a BWR nuclear power station. The results of laboratory tracer experiments and field studies are presented. From a variety of concentration media that were considered for samples of 16 to 400 litres, the following system was selected: cartridge filter (prefilter and 0.45-μm membrane) operated at a flow rate of 15 l/min for collecting radionuclides in suspended material; ion exchange system (300 cm^3 of chelating resin for collecting ^{54}Mn, ^{58}Co and ^{60}Co followed by 200 cm^3 of an inorganic exchanger for ^{134}Cs and ^{137}Cs) operated at a flow rate of 12 l/hr; and precipitation of AgI and then $SrCO_3$ from a volume of 16 litres. The filter and ion exchange samples were counted by gamma spectrometry with a Ge(Li) detector plus 2000-channel analyzer. The detection limit was about 0.01 pCi/l for a 400 litre sample. The AgI and $SrCO_3$ precipitates were chemically purified and determined by beta-particle counting. For samples of 16 litres or less, a sequential procedure is described. By precipitation and batch ion exchange treatment, radionuclides are collected in the following order: iodine, caesium, cobalt, manganese, and strontium. The detection limit of most radionuclides in a 16 litre sample was 0.1 pCi/l. Data are presented regarding the distribution between particulate and dissolved fraction for these radionuclides, as well as some others (^{51}Cr, ^{59}Fe, ^{95}Zr, ^{95}Nb, ^{99}Mo, ^{140}Ba, ^{141}Ce, and ^{144}Ce) that were found in the waste or in fallout. (auth)

14075 INTERCALIBRATION OF METHODS FOR RADIONUCLIDE MEASUREMENTS ON A MARINE SEDIMENT SAMPLE. Fukai, R.; Statham, G. A.; Ballestra, S. (International Lab. of Marine Radioactivity, Monaco). pp 313-335 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); CONF-731117-(P1).

The results reported in the intercalibration of methods for radionuclide measurements on a marine sediment sample are surveyed. The preparation of the marine sediment sample, its homogeneity, and the procedures for intercalibration are also described. Forty-four laboratories from 20 countries participated in this intercalibration exercise during 1972 and 73. The survey of the reported results shows that, although the scatter of the data for the sediment measurements is still considerably large, especially for ruthenium-106, the comparability of the results obtained by different laboratories has been improved, as a whole, when compared with that for the seaweed sample. Nevertheless, a comparison of the results obtained by Ge(Li) γ spectrometry with

other methods indicates that there are still problems of calibration of Ge(Li) γ spectrometers in some laboratories due, perhaps, to the radionuclide standards used and/or the procedures of instrument calibration. The probable concentrations estimated by various statistical treatments of the reported data are presented for major radionuclides reported, such as strontium-90, ruthenium-106, cesium-134, cesium-137 and cerium-144. (auth)

14076 HEAVY METALS AS TRACE CONSTITUENTS IN NATURAL GROUNDWATERS AND POLLUTED. Matthess, G. (Univ., Kiel). Geol. Mijnbouw; 53: No. 4, 149-155(Jul 1974).

The natural and man-made concentrations of heavy metals are discussed concerning their abundance, geochemical mobility, and their physiological effects on man. The many gaps of geochemical information concerning abundance behaviour of heavy elements in the ground should be filled especially for those elements that are important to human health. (NL)

14077 PROPOSALS CONCERNING AN INTERNATIONAL BIOLOGICAL RADIOINDICATOR BASED ON AN EXPERIMENTAL ECOLOGICAL AND ECONOMIC BALANCE. Foulquier, L.; Grauby, A. (CEA, Fontenay-aux-Roses, France). pp 67-88 of Environmental Surveillance Around Nuclear Installations. Vol. II. Vienna; International Atomic Energy Agency (1974). (In French).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol.2); CONF-731117-(P2).

Several nuclear facilities (research reactors, fissile material producing reactors, power reactors) were built in the Rhône basin and have given rise to a variety of radioactive and thermal pollution problems. The hydrological, physico-chemical, and biological conditions in the river Rhône and its delta vary considerably and make it difficult to carry out biological studies with a view to obtaining results which are characteristic of particular zones but, at the same time, sufficiently representative to be used more widely in health protection work. For several years the Laboratoire de Radioécologie Continentale (Continental Radioecology Laboratory) has been studying the ways in which eels (Anguilla anguilla L.) become contaminated by various radionuclides. Eels were chosen because, in the authors' opinion, they possess properties which satisfy the most important criteria of practical radioecological research. Eels occur in large numbers throughout the year in the entire Rhône basin. Thanks to their osmotic regulation mechanism, they can live both in fresh water and in seawater. Comparisons can therefore be made of the activity levels in eels over the whole length of a river basin. Local and international trade in eels is of considerable economic importance. Whether they are consumed locally or exported, they figure prominently in the human food chain. Lastly, it is fairly easy to keep and work with eels in the laboratory, so that a schedule of regular experiments can be drawn up and a large measure of methodological flexibility achieved. By way of example, results relating to the uptake and excretion of ^{85}Sr, ^{137}Cs, ^{51}Cr, and ^{65}Zn by eels in fresh water are summarized. The results cover the dynamics of fixation, the mean concentration factors and the distribution within the animal, indicating critical organs and biological periods. The studies reported show how useful eels are from the radioecological point of view. The biogeography of eels indicates that the reasoning applied to the Rhône basin is valid for many other industrial regions of the world. The authors consider that measurements and experiments involving eels in the different environments where they occur would provide a useful overall indication of radiocontamination levels. (auth)

14078 CONTAMINATION OF LIVING ORGANISMS IN AN ESTUARY BY THE ^{226}Ra PRESENT IN LIQUID EFFLUENTS OF INDUSTRIAL ORIGIN. Kirchmann, R.; Bonotto, S.; Cantillon, G. (CEN, Mol, Belgium). pp 167-183 of Environmental Surveillance Around Nuclear Installations. Vol. II. Vienna; International Atomic Energy Agency (1974). (In French).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol.2); CONF-731117-(P2).

Since 1969 the western arm of the Scheldt estuary has been the object of radioecological investigations in connection with the construction of a 800 MW(e) PWR, which is to enter into service during 1974. The estuary receives liquid effluent of industrial origin contaminated by ^{226}Ra, which is then found in the plants (algae, helophytes) and animals (molluscs, crustaceans, fish) obtained from this biotope. The distribution of the radionuclide in these living organisms was investigated and the ratio ($pCi^{226}Ra$: gCa) calculated for the purpose of determining the discrimination factor. A laboratory study was made of the kinetics of ^{226}Ra fixation and decontamination in various algae (Himanthalia lorea, Fucus vesiculosus, Ascophyllum nodosum, Halidrys sp. and Porphyra sp.) and marine animals (Mytilus edulis, Littorina littorea, Carcinus maenas, Crangon vulgaris, Pleuronectes platessa and Asterias rubens Retz). The results are presented and discussed. The rate of ^{226}Ra transfer in the mussel → crab link of the food chain was determined. (auth)

Ecosystems and Food Cycles

Refer also to abstracts 13630, 14420, 14430, 14441, 15844, 15845, 15849, and 15850.

14079 (FFIF-F-587) ACTIVITY MEASUREMENTS OF FODDER, EXCREMENT, MILK, AND WATER FROM FARMS IN SAMNANGER AND MATRA: AUTUMN 1972. Hetland, A. (Forsvarets Forskningsinstitutt, Kjeller (Norway)). Feb 1973. 14p. (In Norwegian). INIS.

Measurements were carried out on ^{137}Cs in milk, drinking water, fodder, and excreta sampled in Samnanger and Matre districts on the west coast of Norway in the autumn of 1972. The farms were separated into three groups, based on farming and feeding methods. Highest levels of cesium-137 are found when extensive farming methods are used. There is an increase in cesium-137 content compared with the spring values. No significant variation in the values compared with the results from the last two years has been found. (auth)

14080 (UCRL-76313) POTENTIAL PATHWAYS TO MAN FOR RADIONUCLIDES FROM EXCAVATION APPLICATIONS OF PEACEFUL NUCLEAR EXPLOSIVES. Schwartz, L. L.; Tewes, H. A.; Robison, W. L.; Peterson, K. R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 Dec 1974. 36p. (CONF-750109-4). Dep. NTIS $4.75.

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975).

Nuclear explosive excavation is distinguished from other PNE applications by the collateral prompt release of radioactive material. A major consideration in project design is to assure that radiation exposures downwind are kept as low as practicable, as well as below radiation protection guidelines. In addition, application of the technology has international implications in that some of the released radioactivity will be carried across national boundaries, and some will eventually be distributed worldwide. Consequently, the impact of potential radiation exposure resulting from dissemination of radioactive material locally and worldwide, must be included in project feasibility evaluations. Thus, excavation projects must be designed to minimize the potential for biological impact through radiation exposure from all significant pathways to man. The basic methods of accomplishing this are: use of explosives specifically designed for excavation with minimum production of biologically significant radionuclides; detonation under preselected meteorological conditions; and temporary predetonation evacuation of people from the close-in downwind sector in order to minimize potential exposures. This report outlines the pathways of potential radiation exposure to man and summarizes the methodology utilized to predict exposures for nuclear excavation projects. An example of predicted exposures for a major excavation project is summarized. (auth)

14081 APPLICATION OF SYSTEM ANALYSIS METHODOLOGY TO THE DETERMINATION OF THE LIMITING RADIOLOGICAL CAPACITY OF THE AREA SURROUNDING A NUCLEAR FACILITY. Frittelli, L. (CNEN, Rome). pp 425-432 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); CONF-731117-(P1).

Environmental system analysis is an approach that offers considerable promise as a methodology for predicting exposure dose from radionuclides that might be transferred to man through a variety of environmental pathways. After a brief discussion of the method, the model is used to estimate the contribution of each radionuclide and each exposure pathway to the dose received by the public in an area surrounding a nuclear facility owing to the release of radionuclides into the atmosphere and into surface waters. This makes it possible to identify the critical radionuclides, the critical pathways and the critical population group, which are then used in planning a radiological monitoring program in the environs of the nuclear installation. The rate constants for the transfer of radionuclides between the various components of the system are calculated from the literature data or from data on the agricultural and meteorological characteristics of the site and the habits of the potentially exposed individuals. (auth)

14082 DEVELOPMENTS IN THE UNITED KINGDOM IN THE DERIVATION OF EMERGENCY REFERENCE LEVELS IN ENVIRONMENTAL MATERIALS. Bryant, P. M. (National Radio-

logical Protection Board, Harwell, Eng.). pp 457-470 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); CONF-731117-(P1).

Following an accidental escape of radioactive material from a nuclear installation to the environment, limitation in the amount of public radiation exposure might be required. Because of the great variability of the circumstances in which remedial action might be considered, the International Commission on Radiological Protection does not make specific recommendations on action levels, but suggests that the setting of such levels is the responsibility of the national authorities. Guidance on maximum permissible contamination of diet and respirable air published by the United Kingdom Medical Research Council during the period 1959 to 1961 is being reviewed in order to take account of various developments in the intervening period. The concept of maximum permissible radiation exposure in connection with an accidental escape has been superseded by the more flexible concept of an emergency reference level of dose. This is the basic standard; it is not a firm action level but a level at which responsible authorities should judge whether countermeasures should be introduced. Secondary standards are described as derived emergency reference levels; these levels, which may refer to milk, air, or other environmental materials, are intended to provide a basis for estimates of potential radiation exposure on which decisions regarding the application of countermeasures may be made. Other developments considered are changes in reactor types and in the radionuclides which might escape accidentally; also, advances in the metabolic, dosimetric, and food chain data required to derive values for emergency reference levels in environmental materials. Present knowledge regarding radiostrontium metabolism indicates that a completely new approach is necessary, involving a change in the portion of bone considered to be the critical organ. For other radionuclides there are numerical revisions, but no change in critical organ. The present paper describes the developments which led to revised values for derived emergency reference levels (ERLs) corresponding to a given ERL of dose. (auth)

14083 DETERMINATION OF β-ACTIVITY OF FOODSTUFFS AND MENUS. Cieleszky, V.; Czegledi, P.; Dobrovolszky, A.; Hapka, S.; Tarjan, R. (Orszagos Elelmezes- es Taplalkozastudomanyi Intezet, Budapest). Izotoptechnika; 17: No. 11, 521-534 (Nov 1974). (In Hungarian).

The total β activity and potassium activity of foods was determined. The average daily intake of artificial β-activity by foods in Hungary is in the range of 1000 pCi. (auth)

Radiometric Techniques

Refer also to abstract 14213.

14084 (BNL-19496) SULFUR ISOTOPE RATIO TECHNIQUE. Castleman, A. W. Jr.; Munkelwitz, H. R. (Brookhaven National Lab., Upton, N.Y. (USA)). Oct 1974. 14p. Dep. NTIS $4.00.

A major fraction of the stratospheric aerosol layer is comprised of sulfates, thought to be of terrestrial origin. The general distribution of this aerosol layer is discussed. The techniques of isotopic ratio tracing were employed in order to elucidate the mechanisms responsible for the formation of the layer as well as establish the significance of volcanic compared to the other possible sources. Sulfur compounds of terrestrial origin such as SO_2, and possibly H_2S, may enter the stratosphere by three major processes. These include vertical transport via tropical upwellings and major storms, eddy diffusional processes, and injection by explosive volcanic eruptions that presents a significant impulsive loading to the stratosphere on numerous, but irregular intervals. In the case of the element sulfur, the studies utilized the two most abundant stable isotopes of sulfur, ^{32}S and ^{34}S. The results strongly suggest that aerosols carried upward in large storm clouds make only a minor contribution to the persistent globally distributed layer. (CH)

14085 (BNWL-SA-5195) PERTECHNETATE, IODIDE, AND METHYL IODIDE RETENTION BY SURFACE SOILS. Wildung, R. E.; Routson, R. C.; Serne, R. J.; Garland, T. R. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 9 Oct 1974. 7p. (CONF-741121-3). Dep. NTIS $4.00.

From annual meeting of the American Agronomy Society; Chicago, Illinois, USA (10 Nov 1974).

The distribution coefficient (Kd), defined as the ratio, at equilibrium, of the quantity of solute sorbed per gram of soil to solute per ml of equilibrating solution, was determined for pertechnetate-95m, iodide-131, and methyl iodide-131 (trace quantities in 0.01M $CaCl_2$) in 22 soils representing a broad range in particle size distributions, carbonate and organic carbon contents, cation exchange capacities, and soil pH values. Pertechnetate retention was positively correlated with soil organic carbon and cation exchange capacity and negatively correlated with soil pH. Iodide retention was positively correlated with silt content of soil. Methyl iodide retention by soils was positively correlated to clay, organic carbon, and cation exchange capacity and negatively correlated to pH. On the basis of these results it was concluded that the difference in the behavior of pertechnetate and iodide in soils is sufficiently great to preclude extrapolation of iodide studies to pertechnetates and that in surface soils containing sufficient silt, clay, and organic matter pertechnetate, iodide, and methyl iodide have the potential for accumulation. (JSR)

14086 (LA-UR-74-1643) PROBLEMS AND POTENTIALITIES OF STABLE ISOTOPES AS TRACERS FOR STUDYING POLLUTANT BEHAVIOR UNDER FIELD CONDITIONS. Matwiyoff, N. A.; Cowan, G. A.; Ott, D. G.; McInteer, B. B. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 26p. (CONF-741120-5; SM-191/22). Dep. NTIS $4.50.

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974).

The separated stable isotopes of carbon (^{12}C, ^{13}C), oxygen (^{16}O, ^{17}O, ^{18}O), and nitrogen (^{14}N, ^{15}N) (the ICONs) have been available in limited quantities for many years. In practice, the use of these isotopes has been limited primarily for two reasons. First, the separated isotopes in the required chemical forms have been relatively expensive. Second, the analytical instrumentation necessary for their detection and assay has been expensive to acquire and difficult to maintain. Recently this situation has begun to change rapidly and, in this paper, the problems and potentialities of stable isotopes as tracers for studying pollutant behavior under field conditions are reviewed. The potential and actual applications of ICONs for studying pollutant behavior under field conditions will be surveyed with emphasis on: (1) the use of ^{15}N and ^{14}N (depleted in ^{15}N) for tracing N tagged fertilizer; (2) the use of mass spectrometry and nuclear magnetic resonance spectroscopy for studying the distribution and fate of ^{13}C and ^{15}N tagged pesticides in the biosphere; and (3) the use of tagged methane as a tracer for transport and dispersion studies in the atmosphere. (auth)

14087 (NP-20233) DETERMINATION OF MASS OF FILTER-COLLECTED AIR-BORNE PARTICLES BY MEASURING ABSORPTION OF BETA RADIATION. Jansson, A.; Grennfelt, P. (Swedish Water and Air Pollution Research Lab., Goeteborg). May 1974. 22p. Dep. NTIS (US Sales Only) $4.25.

The use of β-radiation absorption measurements for determination of the total mass of filter-collected air-borne particles was investigated for small surface densities. The technique was applied to various types of test dust and atmospheric dust. All the dust showed a dependence between the beta absorption and the surface density of the particles on the filters that differed from the exponential curve which was obtained when using thin foils. The absorption did not only depend on the surface density of the filter-collected particles but also of characteristics of the collected particulate matter. The β-absorption method showed a standard deviation of about 13 $\mu g/cm^2$ and the lowest allowable amount of particles collected on a filter was set to 50 $\mu g/cm^2$. With a filtration area of 1.54 cm^2 and a sampled volume of 8 m^3 the method enables concentrations of particulate matter down to about 10 $\mu g/cm^3$ to be measured. (auth)

14088 (STI/PUB-361) EFFECTS OF AGRICULTURAL PRODUCTION ON NITRATES IN FOOD AND WATER WITH PARTICULAR REFERENCE TO ISOTOPE STUDIES. Panel Proceedings Series. Conference Held in Vienna, Austria, June 4-8, 1973. (International Atomic Energy Agency, Vienna (Austria)). Aug 1974. 163p. (CONF-7306107-). $8.00.

Growing world population, food demands and changing social patterns have dictated the introduction of intensive agricultural practices. The possibility that nitrogenous residues from intensive fertilizer use or animal waste disposal practices may contribute to the growing problems of eutrophication of inland waters or rising nitrate concentrations in certain potable water supplies is discussed in 13 papers. The importance of the stable isotope ^{15}N as an isotopic tracer of fertilizer nitrogen under field conditions and the possible use of natural $^{15}N/^{14}N$ isotope ratios for distinguishing between fertilizer nitrogen from other possible sources are also discussed. (CH)

14089 "MANTLE" Rb/Sr AND $^{87}Sr/^{86}Sr$ RATIOS FOR CLINOPYROXENES FROM NORWEGIAN GARNET PERIDOTITES

AND PYROXENITES. Brueckner, H. K. (Columbia Univ., Palisades, N. Y. (USA). Lamont-Doherty Geological Observatory). Earth Planet. Sci. Lett.; 24: No. 1, 26-32(Nov 1974).

Clinopyroxenes separated from garnetiferous ultramafic rocks in the core zone of the Norwegian Caledonides have rubidium concentrations of 0.008 to 0.064 ppM, strontium concentrations of 23.5 to 421 ppM, and $^{87}Sr/^{86}Sr$ ratios of 0.7011 to 0.7029. The very low Rb/Sr ratios of the clinopyroxenes (less than 0.0004) suggest that their $^{87}Sr/^{86}Sr$ values have not varied significantly over geologic time and may approximate the initial $^{87}Sr/^{86}Sr$ of the eclogite-facies ultramafic mineral assemblages at their time of formation. The ultramafic rocks occur in a basement complex that yields Rb–Sr whole-rock and U–Pb zircon ages of about 1800 m.y. Garnetiferous ultramafic rocks are apparently lacking in younger (Sveconorwegian or Caledonian) sialic sequences, raising the possibility that the eclogite-facies metamorphism may have occurred at least 1800 m.y. ago. The Rb/Sr and $^{87}Sr/^{86}Sr$ ratios of the clinopyroxenes are as predicted for the ancient upper mantle under most evolutionary models. However, the data do not preclude the possibility that the eclogite-facies metamorphism occurred in the crust. The garnetiferous ultramafic rocks are generally enclosed by large volumes of dunite which could have shielded the eclogite-facies assemblages from contamination by fluids from the country rock during metamorphism. (auth)

14090 Rb–Sr RADIOMETRIC AGE OF LATE PRECAMBRIAN FOSSIL-BEARING AND ASSOCIATED ROCKS FROM SINAI. Shimron, A. E. (Hebrew Univ., Jerusalem (Israel)); Brookins, D. G. (New Mexico Univ., Albuquerque (USA)). Earth Planet. Sci. Lett.; 24: No. 1, 136-140(Nov 1974).

Six samples of metamorphic rocks from three essentially coeval stratigraphic units, two of which contain Precambrian microfossils, were analyzed by the Rb–Sr whole-rock radiometric method. Least-squares regression of the data yields an isochron date of 934 ± 80 m.y. with initial $^{87}Sr/^{86}Sr$ = 0.7007 ± 0.0011. This date may reflect the approximate age of formation of these rocks or, alternately, a time of major metamorphism. Regardless, the date is significant in that it (a) is in agreement with the 900-m.y. date for rocks containing similar types of fossils from Bitter Springs, Australia, and (b) coupled with structural evidence, supports the time equivalence of these rocks with 1000-m.y. old rocks ("Kibaran cycle") of Saudi Arabia. (auth)

14091 EDDY VISCOSITY PROFILE IN UPPER OCEANIC LAYERS DERIVED FROM RADON MEASUREMENTS. Klug, W. (Technische Univ., Darmstadt, Ger.). Tellus; 26: No. 1-2, 36-38(1974).

From symposium on trace gases; Mainz, Germany (2 Apr 1973).

In a recent paper Broecker & Peng (1971) published measurements of the vertical distribution of radon-222 in the upper layers of the ocean in the Bomex area (about 15°N, 46°W). It is estimated from these measurements under the assumption of a constant eddy diffusion coefficient K_z that in the upper 20 meters $K_z > 160$ cm^2 sec^{-1} and in a depth between 20 and 80 m that K_z must be about 4 cm^2 sec^{-1}. Since not much information is available about the vertical eddy diffusivity profile in the upper layers of the ocean it was considered worthwhile to try to obtain such a profile from the published data. The published radon profile is redrawn. This is a smoothed profile as it was obtained by the authors mentioned. This profile is used to draw conclusions for the eddy viscosity profile. (auth)

14092 GAS EXCHANGE RATES BETWEEN AIR AND SEA. Broecker, W. S.; Peng, T. H. (Columbia Univ., Palisades, NY). Tellus; 26: No. 1-2, 21-35(1974).

From symposium on trace gases; Mainz, Germany (2 Apr 1973).

Gas exchange rate studies carried out in the laboratory suggest that the stagnant film model is adequate to relate the transfer coefficients of most gases between the atmosphere and sea to an accuracy of ±15%. Estimates of the average film thickness prevailing for the world ocean based on the distribution of natural radiocarbon, bomb-produced radiocarbon, and radon are in good agreement. Radon data from the BOMEX area and from station PAPA lend support to Kanwisher's suggestion that gas exchange rates should vary in proportion to the square of the wind velocity. These observations permit a number of generalizations regarding the potential of the ocean as a source and sink for trace gases to be made. They also permit the more complicated situation for carbon dioxide to be assessed. (auth)

Site Surveys

Refer also to abstract 13816.

14093 (BMI-171-156) AMCHITKA BIOENVIRONMENTAL PROGRAM. Research Program on Marine Ecology, Amchitka Island, Alaska. Annual Progress Report, July 1972–September 1973 and Summary Report 1967–1973. Nakatani, R. E.; Burgner, R. L. (Washington Univ., Seattle (USA). Fisheries Research Inst.). Nov 1974. Contract AT(26-1)-171. 105p. Dep. NTIS $8.25.

For Battelle Columbus Labs., Ohio.

Amchitka research activities of FY 1973 and highlights of the entire program on the marine ecology of Amchitka since its inception in July, 1967 are presented. The primary mission of the program was to assess and evaluate both the short and long termed effects of the Milrow (October 2, 1969) and the Cannikin (November 6, 1971) underground nuclear tests on the marine environment and biota. While most of the program efforts were devoted to evaluating test effects, much work was in fundamental research, such as taxonomic work, to obtain baseline information so as to assess and intelligently interpret the changes observed after the tests. The FY 1973 work covered largely the evaluation of the effects of Cannikin 1-year post-event and the effects of Milrow 3-year post-event. Recovery of fish populations in localized offshore and nearshore waters to pre-Cannikin levels has occurred because of immigration from adjacent areas. Fish habitat disruption was localized and was not great enough to reduce significantly the carrying capacity of disrupted areas. Algal recolonization has occurred and invertebrate communities have also recovered. It appears that long-term biological damage by Cannikin or Milrow to the marine communities studied is negligible. Although permanent physical changes occurred in localized portions of intertidal benches, adjacent cliffs, and possibly to some subtidal formations, only 6.1 km of approximately 190 km of total island coastline was permanently uplifted and disturbed by Cannikin. (CH)

14094 (BNWL-SA-5194) SEASONAL DISTRIBUTION OF MERCURY IN WATER, SUSPENDED MATTER AND SEDIMENTS OF THE LOWER COLUMBIA RIVER WATERSHED. Garland, T. R.; Wildung, R. E. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 7 Oct 1974. 17p. (CONF-741121-4). Dep. NTIS $4.00.

From annual meeting of the American Agronomy Society; Chicago, Illinois, USA (10 Nov 1974).

Studies were conducted on: seasonal variation in particle size fractions and physical and chemical characteristics of the fractions; analysis of filtered water, suspended matter, and sediment; seasonal variation in Hg in the suspended matter and water of the Columbia River tributaries; vertical distribution of suspended matter in relation to Hg levels; chemical forms of Hg in the Columbia River; and distribution of Hg in Columbia River sediment cores. (HLW)

14095 (DOCKET-701193-7) CIMARRON PLUTONIUM PRODUCTION PLANT. Applicant's Environmental Report, Supplement 4. (Kerr-McGee Corp., Oklahoma City, Okla. (USA)). Nov 1974. 53p. Dep. NTIS $5.75.

Drawings, design calculations, and estimates of costs of a proposed building to completely cover and enclose in a protective shell the Cimarron Facility Plutonium Plant of the Kerr-McGee Corporation at Crescent, Oklahoma are presented. The shell is intended to protect the facility against the forces of a tornado. Several methods of tornado protection were considered. The one selected was considered to be the least expensive and most protective. (auth)

14096 (DP-1369) ENVIRONMENTAL EFFECTS OF A TRITIUM GAS RELEASE FROM THE SAVANNAH RIVER PLANT ON MAY 2, 1974. Marter, W. L. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Nov 1974. Contract AT(07-2)-1. 28p. Dep. NTIS $4.00.

On May 2, 1974, 479,000 Ci of tritium gas was released from a Savannah River Plant exhaust stack to the atmosphere over a period of about four minutes. The release resulted from a metallurgical failure of a process valve in a tritium processing facility. Light winds of 4 to 6 mph carried the tritium in a northeasterly direction. Calculations indicate it passed out to sea from the southern half of the North Carolina coast about 36 hours after the release. Measurements of tritium offplant indicated that less than 1% of the tritium was in the oxide form. A maximum potential dose to a person (from inhalation and skin absorption) at the puff centerline on the plant boundary was calculated to be 0.14 mrem, less than 1% of the annual dose received from natural radioactivity. The population dose was calculated to be 8 man-rem before the tritium passed out to sea. An extensive environmental sampling program was conducted after the release to verify the predicted trajectory of the tritium and to determine potential individual dose commitment. Approximately 1000 samples were collected and analyzed; these included air moisture, elemental

tritium gas in the atmosphere, pine needles, grass, food crops, milk, surface water, soil, and human urine. Inhalation doses were <0.05 mrem; that is, urine analyses were less than the sensitivity of analysis (<0.005 μCi/l). Potential individual doses from consumption of tritium-bearing food crops and milk were less than 1 mrem. The trajectory of the tritium puff was verified by analysis of vegetation at a distance of about 45 miles northeast from the plant boundary; beyond this point, tritium concentration in vegetation was generally less than 14 pCi/ml (free water) and variable (within the normal range of concentrations found in this area), making trajectory tracking impractical. (auth)

14097 (INIS-mf-1519) AUTOMATION OF WEATHER-DATA COLLECTION. Hancke, G. P.; Morgan, P. R. (Atomic Energy Board, Pelindaba, Pretoria (South Africa). Instrumentation Div.). Nov 1973. 3p. (In Afrikaans). INIS.

Meteorological data is obtained from two sources on the site: a mechanical weather station in the garden opposite the administration building; surveys made in the emergency control center. The display signals are relayed from detectors in the reactor tower. The data is converted into a form that can be fed into the IBM-computer. The object of this study was to find a system that can automate the data-compilation to a more direct method of input into the IBM. A cost-analysis of such a system is also made. (INIS)

14098 (NP-20287) WATER AND POLLUTION PROBLEMS WITH NUCLEAR POWER PLANTS. Preliminary Report on Investigations in 1973. Knutzen, J.; Skulberg, O. (Norsk Institutt for Vannforskning, Oslo). 1 Dec 1973. 22p. (In Norwegian). Dep. NTIS (US Sales Only) $4.25.

Field observations and experimental investigations with aquatic plant and animal species and populations from Oslofjord have shown the significance of temperature for important biological parameters, such as primary production, the composition of the plankton populations, and for the maturing and mortality of crustaceans and fish. Measurable effects were found with temperature increases of the magnitude expected from thermal effluents from nuclear power plants. Investigations carried out in 1973 do not give grounds to change previous (negative) evaluations of the suitability of Oslofjord as a recipient for cooling water discharge from a nuclear power plant. A discharge of 200 m^3/s of heated water would be less doubtful in waters with more clearly defined hydrological conditions. Thermal influences on measures for the purification of the fjord are the subject of an introductory discussion. (NO)

14099 (NP-20288) RELEASE OF RADIOACTIVE MATERIAL FROM NUCLEAR POWER PLANTS. Report No. 1. Background Data for Elements in Oceanic Water, and Water, Organisms and Sediments in the Oslofjord. Rygg, B. (Norsk Institutt for Vannforskning, Oslo). 3 Jan 1974. 30p. (In Norwegian). Dep. NTIS (US Sales Only) $4.50.

In order to evaluate the radioecological effects of effluents from a nuclear power plant discharged to coastal waters, it is necessary to have a description of the original state of the location. Existing data is presented here for the normal concentrations of elements in ocean water, and their concentrations in water, organisms, and sediments in the Oslofjord. Of the latter three environmental components the sediments are the best known. Knowledge of the various elements in the water and especially in organisms is insufficient to calculate concentration factors specifically for the Oslofjord. (NO)

14100 (UCRL-75832) OBSERVATIONS OF DUST FLUX IN THE SURFACE BOUNDARY LAYER FOR STEADY AND NON-STEADY CASES. Shinn, J. H.; Kennedy, N. C.; Koval, J. S.; Clegg, B. R.; Porch, W. M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 20 Sep 1974. 23p. Dep. NTIS $4.25.

Dust flux measurements by the eddy-correlation method are compared for several cases of strong steady winds and intermittent gust fronts. Observations of mass concentrations, mass flux, and particle size distributions during a dust storm in Plains, Texas are shown to contrast with observations at the GMX location of the Nevada Test Site. The calculation of flux for analysis and evaluation of health hazards due to resuspension of respirable particulates is simplified by parameterization to friction velocity and erodibility. The dust concentration is shown to sometimes vary with the sixth power of the wind speed. From the limited data available, a parametric vertical dust flux model is proposed which is general for the types of dry, unvegetated sites reported. (auth)

14101 LITTORAL DRIFT IN THE ENVIRONS OF TARAPUR ATOMIC POWER STATION. Sastry, J. S.; D'Souza, R. S. (Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.). J. Inst. Eng. (India); 53: No. pt.CI3, 170-176 (Jan 1973).

An analysis of swell characteristics in the eastern Arabian Sea is presented. Based on these swell statistics, an evaluation of littoral drift in the neighbourhood of Tarapur Atomic Power Station was made. These studies show a closed circulation of littoral drift on the southern side and a gradual accretion of material on the northern side of the power station. (auth)

14102 NECESSITY FOR ENVIRONMENTAL SURVEILLANCE IN THE EVALUATION OF NUCLEAR POWER PLANT SITES. Handge, P.; Hoffman, F. O. (Technische Univ., Cologne). pp 65-85 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); CONF-731117-(P1).

In order to determine the suitability of a particular site for a nuclear power plant, the potential radiological burden to the surrounding population must be predicted to ensure that the radiological protection guidelines will not be exceeded when the plant is in operation. In the Federal Republic of Germany, however, the necessary information for such predictions is often known only on a global basis. Although conservative values have generally been assumed for prediction purposes, their use does not guarantee adherence to the guidelines in all situations, especially where environmental transport of ^{131}I over the pasture-cow-milk pathway is concerned. This problem is, therefore, studied for typical topographical conditions found in the Federal Republic of Germany. The influences of the meteorological, topographical, and ecological conditions on the potential radiological burden are studied in detail, and critical conditions that have to be considered when determining the need for environmental surveillance are classified accordingly. In addition, the locations where pre-operational and operational environmental monitoring are necessary are discussed, referring also to the use of biological samples as indicators of potential radiation burdens and environmental contamination. Considering the restrictive dose rate guideline of 90 mrem/a to the thyroid, the necessity of environmental surveillance is confirmed for those sites located in mountain-valley complexes or near large bodies of water, or for facilities equipped with short stacks. Because of the possibility of environmental accumulation of long-lived isotopes as a result of future growth of the nuclear industry, environmental surveillance would prove useful for all sites. To illustrate the need for environmental surveillance when site-specific information is not available, an example of a site located in a mountain-valley complex has been included. (auth)

14103 ENVIRONMENTAL GAMMA RADIATION MEASUREMENTS IN NUCLEAR POWER STATION SITING STUDIES IN POLAND. Gwiazdowski, B.; Pensko, J.; Jagielak, J.; Biernacka, M.; Mamont-Ciesla, K. (Central Lab. for Radiation Protection, Warsaw). pp 89-105 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); CONF-731117-(P1).

A survey of environmental natural γ background radiation in a region surrounding one of the proposed nuclear power station sites in Poland, in the vicinity of Żarnowieckie Lake, is described. Over a three-year period, a program of field measurements using a portable high-pressure ionization chamber and an airborne monitor and with spectrometric evaluation of soil samples was completed. The program of surface measurements comprised the survey of γ background exposure dose rate at one meter above the ground at 100 measurement points distributed over a region of 40 km radius. The airborne monitor survey was made by recording the dose rate during flights on parallel paths 2 km apart. The dose rate was determined for ground level over a square net of points spaced at 2 km sides, which was the base used for drawing up the map of dose-rate distribution. The method used for the survey and the results obtained are discussed. (auth)

14104 STUDY OF THE BACKGROUND RADIATION AROUND THE CONSTRUCTION SITE OF A NUCLEAR POWER STATION IN BULGARIA WITH A VIEW TO CONTROLLING THE RADIOLOGICAL HEALTH OF THE POPULATION IN THE FUTURE. Vasilev, G.; Yotov, M.; Keslev, D. (Inst. of Radiobiology and Radiation Hygiene, Sofia). pp 107-110 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); CONF-731117-(P1).

The first nuclear power station in Bulgaria is being constructed near the town of Koslöduy. Since 1968 a study of the different factors that characterize the natural background radioactivity in the region around the station has been in progress. With a view to the

future, when the power station is operational, a special control system was created for checking the radiological status of the health of the population in the surrounding region. (auth)

14105 MOVEMENT OF RADIONUCLIDES IN THE GROUND IN RELATION TO THE ENVIRONMENTAL SAFETY OF NUCLEAR POWER PLANTS. Dlouhy, Z.; Safar, O. (Inst. of Nuclear Research, Rez, Czech.). pp 111-119 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); CONF-731117-(P1).

During the operation of nuclear power plants, damage to any of the systems in which liquid radioactive wastes are transported or stored might occur; this could lead to contamination of the ground. To estimate the size of the hazard of population exposure in the environs of the plant, it is necessary to estimate the consequences of such an accident in advance. This requires a detailed knowledge of the underground water flow as well as the sorption properties of the soils which form the geological structure of the zone at and around the site. To this end, the authors have evaluated a site in Czechoslovakia on which the building of a 1760 MW(e) nuclear power plant is proposed for the period 1978 to 1983. (auth)

14106 NATURAL GAMMA BACKGROUND RADIATION IN THE ENVIRONS OF NUCLEAR FACILITIES. Pre-Operational Analysis of Dose to the Neighboring Population. Pensko, J. (Inst. for Nuclear Research, Swierk, Poland). pp 121-130 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); CONF-731117-(P1).

The method of calculating and calculations of the mean values of the natural background γ dose-rate equivalent for gonads and bone marrow of an individual are presented for the inhabitants of one district in Poland taken at random. These values, weighted to allow for some of the most important environmental factors, were 78.0 mrem/a for gonads and 72.1 mrem/a for bone marrow. The collective dose from this source of radiation for the district under investigation does not exceed 1.2×10^4 man · rem/a. The calculations were carried out based mainly upon measurements made using a scintillation radiometer installed in an aeroplane. Numerous measurements of the exposure dose rate at a height of 1 m above the ground level taken using a high-pressure ionization chamber, in addition to the results of gamma spectrometric analyses of soil samples, were also taken into account. The body absorbed dose conversion factors were considered, as was time spent by the inhabitants indoors. The use of an appropriate weighting factor for making allowances for the radiological properties of building materials is proposed. The method can be used for estimating mean population dose due to external radiation originated from natural and artificial radioactive sources present in the environs of nuclear facilities. (auth)

Thermal Effluents

Refer also to abstract 14098.

14107 (BNWL-SA-5206) EFFECTS OF THERMAL AND CHEMICAL DISCHARGES FROM NUCLEAR POWER PLANTS. Templeton, W. L.; Schneider, M. J.; Gibson, C. I. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. 33p. (CONF-741137-1). Dep. NTIS $4.75.

From research coordination meeting on the physical and biological effects in the environment of cooling systems and thermal discharges at nuclear power stations; Oak Ridge, Tennessee, USA (18 Nov 1974).

Results are reported from laboratory studies on the response of physically fatigued fish to elevated water temperatures. The concentrations of blood lactic acid and glucose were chosen to monitor the fatigue level in rainbow trout, Salmo gairdneri. As an ultimate measure of fish response to water temperature and work, loss of equilibrium and death were used. The effects of cold shock on loss of equilibrium and induction of cold coma were also studied in rainbow trout, sunfish, and crayfish acclimated to temperatures ranging from 15°C to 30°C and subjected to temperature declines of 1°C to 18°C per hour. Field studies were made on the response of fish populations to thermal discharges, and the effects of the supersaturation of natural waters with atmospheric gases on the induction of bubble gas disease and survival of 10 species of fish. The combined effects of thermal effluents and chlorine content in water on the survival of rainbow trout, brook trout (Salvelinus fontinalis) and crayfish (Pacifasticus leniusculus), the principal food of trout, were investigated. Differences in resistance were observed between species exposed to residual chlorine content ranging from 0.082 to 0.039 ppM at temperatures ranging from 10 to 20°C. (CH)

14108 (COM-73-11291) EFFECTS OF A HAWAIIAN POWER PLANT ON THE DISTRIBUTION AND ABUNDANCE OF REEF FISHES. Sea Grant Advisory Report. McCain, J. C.; Peck, J. M., Jr. (Hawaii Univ., Honolulu (USA)). Jun 1973. Contract NOAA-043-158-29. 22p. (NOAA-73080104). NTIS $2.75.

The Kahe Steam-Electric Generating Station's thermal discharge induces a change in the species composition of fishes in those areas where the plume normally reaches the bottom. This shift appears to be related to an increase in benthic algal standing crop which may support the large numbers of fishes, primarily acanthuridae. The species composition of fishes in the deeper reef areas (greater than 7 meters depth) differs from that of shallower nearshore stations. The fish fauna of areas adjacent to large rocks, such as jetties, differs from that of reef areas. The thermal plume of the power plant induces a marked increase in fish standing crop directly at the outfall, due primarily to the increase in the numbers of herbivorous species. Fish standing crop estimates for the Kahe Point reefs generally agree with such estimates from other Hawaiian reef areas, ranging from 450 kg/hectare (400 pounds/acre) nearshore to 1960 hg/hectare (1750 pounds/acre) on the deeper reefs. This includes the area directly adjacent to the plant discharge, where the biomass was estimated to exceed 5600 kg/hectare (500 pounds/acre). (auth)

14109 (COO-3062-19) THREE DIMENSIONAL HEATED SURFACE JET IN A CROSS FLOW. Technical Report 88. Carter, H. H.; Regier, R. (Johns Hopkins Univ., Baltimore, Md. (USA). Chesapeake Bay Inst.). Nov 1974. Contract AT(11-1)-3062. 82p. Dep. NTIS $7.25.

Various characteristics of 3-dimensional heated surface jets in a cross flow were measured in a large, low-velocity flume. The characteristics studied were vertical growth, lateral spread, centerline trajectory, and dilution. (auth)

14110 (ORNL-TM-4695) SURVIVAL OF LARVAL STRIPED BASS EXPOSED TO FLUID-INDUCED AND THERMAL STRESSES IN A SIMULATED CONDENSER TUBE. Coutant, C. C.; Kedl, R. J. (Oak Ridge National Lab., Tenn. (USA)). Jan 1975. Contract W-7405-eng-26. 44p. Dep. NTIS $5.25.

Single passage of approximately 2-wk-old larval striped bass, Morone saxatilis, through a laboratory mock-up of a power plant condenser tube (not including a pump) resulted in mortalities no greater than for controls, when only mechanical stresses were exerted. When temperature stress was added, mortalities were comparable to thermal bioassay results. The experiments were conducted using different combinations of turbulent shear, pressure change, and temperature rise. The condenser tube is unlikely as the locus of mechanical damages to fish larvae seen at operating power plants. Further research with pumps is recommended. (auth)

14111 (ORNL-tr-2787) RATE OF PHOTOSYNTHESIS IN PHYTOPLANKTON IN THE DISCHARGED WATERS OF THE KONAKOVO THERMAL ELECTRIC POWER STATION. Purina, I. L.; Naumova, E. I. Translated by H. S. Warren from Biol. Vnutr. Vod, Inform. Byull.; No. 17, 18-22(1973). 6p. Dep. NTIS $4.00.

The Konakovo fossil-fuel thermal electric power station works according to a direct-flow system, that is, water which enters the power plant from the Ivankovo Reservoir is discharged back into the water supply. The waters remain approximately ten minutes in the power station and are heated in this time 8 to 10 degrees. They then fall into the drainage canal, which terminates after approximately 1 to 2 hours, and are cooled after this time 2 to 3 degrees. From the canal, the water enters Moshkovich Bay, and subsequently after 4 to 6 hours, the Reservoir. According to measurements in passage through the Bay, the waters cool noticeably, so that on leaving it, the temperature is only 2 to 3 degrees higher than that in the water intake. The effects of temperature changes in the water on the rate of photosynthesis of phytoplankton were studied. Seasonal variations were observed. (CH)

14112 (PB-221533) COMBINED EFFECT OF THERMAL AND ORGANIC POLLUTION ON OXYGEN SAG CURVE. Final Technical Report. Keshavan, K.; Sornberger, G. C. (Worcester Polytechnic Inst., Mass. (USA)). 1973. Contract DI-14-31-0001-3674. 46p. (OWRR-C-3027(3674); W-73-11423). NTIS $3.00.

A deterministic model was developed for the oxygen sag curve for a variable temperature condition under thermal overload. With the help of the above model, optimal locations of thermal and organic outlets with respect to each other can be determined for a predetermined minimum dissolved oxygen concentration in the river. (auth)

14113 (PB-232988) EFFECTS OF TEMPERATURE ON DISEASES OF SALMONID FISHES. Ecological Research Series. Fryer, J. L.; Pilcher, K. S. (Oregon State Univ., Corvallis (USA). Dept. of Microbiology). Jan 1974. 119p. GPO $1.55.

The effect of water temperature on infections of salmonid fish was investigated. Chondrococcus columnaris infection was studied in rainbow trout, coho, and spring chinook salmon, Aeromonas salmonicida infection in coho and spring chinook salmon; and Aeromonas liquefaciens infection in steelhead trout. In all cases mortality rates were high at 64 to 69°F; moderate at 54 to 59°F; and low or zero at 39 to 49°F. Progress of the infections was accelerated at higher temperatures, and progressively retarded at decreasing temperature levels. In infection of coho with Ceratomyxa shasta, mortality was high at 69°F, low at 49 to 54°F, and zero at 39 to 44°F. This infection in rainbow trout resulted in high mortality at all temperatures except 39°F. In both cases the course of the disease was most rapid at higher temperatures, and became progressively slower as the temperature decreased. For infection of Kokanee salmon fingerlings with sockeye salmon virus, the temperature range of 54 to 59°F was optimal. (GRA)

14114 (TID-26692) ECOLOGY OF ANURAN POPULATIONS INHABITING THERMALLY STRESSED AQUATIC ECOSYSTEMS, WITH EMPHASIS ON LARVAL RANA PIPIENS AND BUFO TERRESTRIS. Nelson, D. H. (Michigan State Univ., East Lansing (USA)). 1974. 190p.

Thesis.

Field and laboratory studies were conducted to determine the responses of anuran populations to thermally stressed aquatic ecosystems. Adult and larval amphibians were sampled in and around a cool arm of a 67 ha reservoir that receives high temperature effluent from a nuclear production reactor on the Savannah River Plant (SRP) in South Carolina. Adult amphibians were sampled in a mark-release program over a 13-month period by pitfall traps placed peripheral to the reservoir. Species diversity, relative abundance, seasonal occurrence, and activity patterns were compared among dominant anurans inhabiting the area. These patterns for some species were compared with data from nearby unheated areas and analyzed in terms of the thermal gradient (16 to 45°C) extending the length of the reservoir's cool arm. Larval amphibians were routinely sampled for 15 successive months by dipnets and minnow traps from two stations in the heated reservoir and from five cool seepage ponds flanking the reservoir. All specimens were identified, and larval Rana pipiens and Bufo terrestris were measured for length and staged according to the level of development. Although temperature responses must be interpreted at sensitive developmental stages for each species, certain generalities of growth and development apparently hold true within the range of thermal tolerance. It is clear that local physical microhabitats can be altered or effluent temperatures regulated in order to guarantee marginal survival of dominant aquatic populations, and thereby safeguard the stability of the stressed community. (ERB)

14115 RAPID PORE WATER ANALYSIS FOR SEDIMENTS ADJACENT TO REACTOR DISCHARGES. Kalil, E. K. (Univ. of California, Los Angeles). pp 269-283 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); CONF-731117-(P1).

Heat dissipated from nuclear reactors into the ocean or rivers may cause an increase in the microbiological activity within the sediments which, coupled with an increase in biological productivity in the water column, may result in environmental changes. Bacterial sulfate reduction will occur in organic-rich sediment near the sediment-water interface and will result in production of toxic hydrogen sulfide (H_2S), which may suppress benthonic life on the ocean floor. An integrated approach is presented for collection, handling, and analysis of sediments adjacent to reactor cooling water discharge. Samples are collected by gravity cores or grab samplers and transferred with minimal air contact to a squeezing chamber. The pore (interstitial) waters are squeezed from the sediment on board ship, filtered and collected in air-tight plastic syringes. Separation of pore waters allows analysis of dissolved elements that enter the sediments from the overlying water or by release from the solid phase. Radioactivity can be readily assayed without interference from the solid detrital material of the sediment. The squeezer designed for this work is constructed from unreactive materials, and is simple to operate, allowing rapid processing in the field. For this study, a flow-through electrode cell was connected to the squeezer in order to measure pH-value, total H_2S and the oxidation-reduction potential (Eh) from the pore water effluent. A unique calibration procedure was developed for use of an Ag_2SI sulfide electrode over a continuous pH range. The system is sensitive to at least 0.1 micromolar or 0.003 ppM H_2S. The H_2S, Eh and pH profiles in sediment samples will rapidly show any microbiological effect caused by anomalous bottom conditions resulting from reactor discharge or other perturbations in the aquatic environment. Water exhausted from the flow-through cell is collected and can be examined for other chemical parameters of interest. (auth)

Chemical Effluents

Refer also to abstracts 14014, 14021, 14022, 14084, 14088, and 14107.

14116 (BNWL-SA-5116) ENTRAINMENT OF TRACERS INTO CONVECTIVE CLOUDS AT 10 TO 13.5 THOUSAND FEET NEAR ST. LOUIS. Young, J. A.; Tanner, T. M.; Thomas, C. W.; Wogman, N. A. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. Contract AT(45-1)-1830. 16p. (CONF-741003-10). Dep. NTIS $4.00.

From precipitation scavenging conference; Champaign, Illinois, USA (13 Oct 1974).

Six inert tracers were released sequentially at 10 to 13.5 thousand feet near the edges of two convective clouds in the St. Louis area on August 3, 1972 to determine whether air was being entrained into the clouds at these altitudes, and to determine the extent to which the particulate contaminants in the entrained air were being scavenged by the precipitation. The results indicate that the tracers released at 10 to 13.5 thousand feet near the upwind edges of the convective clouds were nearly completely scavenged. The tracers evidently spread from cell to cell, since each tracer appeared in comparable amounts in the precipitation from both cells. Measurable concentrations of the tracers were present in precipitation at the eastward edge of the precipitation network 20 to 30 miles downwind of the tracer releases, indicating that the tracers were probably also present in precipitation falling further downwind outside the network. (auth)

14117 (ORNL-tr-2871) ECOLOGICAL STUDY OF THE MERCURY-BEARING AREA OF MONTE AMIATA. Bombace, M. A.; Rossi, L. C.; Clemente, G. F.; Labellate, G. Z.; Allegrini, M.; Lanzola, E.; Gatti, L. Translated from Ig. Sanita Pubblica; 29: 191-237(1973). 43p. Dep. NTIS $5.25.

The Monte Amiata area (Toscana, Italy) was chosen for a study on the transfer of mercury to the environment, owing to the presence in the area of several mines and metallurgical plants. The same criteria already followed in radioecological surveys were applied. Such criteria lead to the definition of critical area, that is, areas in which the concentration of the metal is particularly high. Many samples of surface water, sediments, plants, vegetables, foodstuff, air, and human hair, and some cooked foods were collected. The mercury determinations were carried on according to two different methods: thermal neutron activation and atomic absorption. A preliminary dietary survey was also made, leading to an estimation of the mercury intake of the population of the area under consideration. (auth)

14118 NON-RADIOACTIVE EFFLUENTS FROM NUCLEAR INSTALLATIONS. Kamath, P. R.; Viswanathan, S.; Gurg, R. P. (Bhabha Atomic Research Centre, Bombay). pp 413-423 of Environmental Surveillance Around Nuclear Installations. Vol. II. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 2); CONF-731117-(P2).

An overall picture is presented of the non-radioactive effluents and wastes expected to arise from the nuclear installations in India, namely, the uranium mines and mill at Jadugada, the nuclear fuel complex at Hyderabad, and at the Rajasthan atomic power plant where a heavy water plant will also be built. The surveys and studies made on the effluents and wastes at the three sites are presented and discussed. (auth)

INSTRUMENTATION

Radiation Detection Instruments

Refer also to abstract 15577.

General Detectors and Monitors

Refer also to abstracts 14044, 14062–14064, 14357, 14402, 14449, 14708, 14748, and 15680.

14119 (CEA-N-1690) NUCLEAR ELECTRONIC EQUIPMENT FOR CONTROL AND MONITORING BOARDS. Susceptibility of Nuclear Electronic Pulse Equipment to Interference Effects. Buisson, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Services d'Electronique). Jul 1972. 27p. (In French). Dep. NTIS (US Sales Only) $4.50.

The correct functioning of pulse measurement units under industrial environmental conditions leads to numerous difficult installation problems. Some recommendations are suggested for minimizing the effects of electrical interference on the electronic equipment and a test method is indicated which allows qualitative evaluations to be made of the importance of these effects. The measurements made refer to nuclear electronic instrumentation but may also be suitable for other types of equipment and different conditions. The effects of interference, the terminology, and the design of the equipment are briefly mentioned together with the recommended connections. A testing method is then presented and various comments made. (FR)

14120 (CEA-R-4449) TESTS OF DIFFERENT COINCIDENCE SYSTEMS WITH LARGE VOLUME Ge-Li DETECTORS. Bek-Uzarov, D.; Clement, C. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Div. de Chimie). Nov 1974. 23p. (In French). Dep. NTIS (US Sales Only) $4.25.

To achieve coincidence measurements in a large energy range the following systems were checked : a simple discriminator, a two threshold discriminator, a constant amplitude fraction discriminator, and a duration discriminator. Three Ge-Li detectors were used (35 to 50 cc). A plastic scintillator with a fast photomultiplier gave a time reference. The characteristics of the coincidence systems were established for different situations. (auth)

14121 (CONF-741212-7) BASIC LIMITATION OF SCINTILLATION COUNTERS IN TIME MEASUREMENTS. Lynch, F. J. (Argonne National Lab., Ill. (USA)). 1974. 12p. Dep. NTIS $4.00.

From 14th scintillation and semiconductor symposium; Washington, District of Columbia, USA (11 Dec 1974).

The time resolution of a scintillation detector can be calculated from the scintillator illumination function, and the response of the photomultiplier to an instantaneous pulse of light. Such calculations using the parameters of present scintillators and photomultipliers agree with measured resolutions and predict improvements which can be achieved. Parameters of commercial and some promising experimental fast scintillators are given, as well as measurements on transit time spread of some fast photomultipliers. (auth)

14122 (CONF-741213-2) DESIGN PARAMETERS AND TEST RESULTS FOR A FISSION COUNTER INTENDED FOR OPERATION UP TO 750°F AT HIGH GAMMA DOSE RATES. Pare, V. K.; Clay, W. T.; DeLorenzo, J. T.; Guerrant, G. C. (Oak Ridge National Lab., Tenn. (USA)). 1974. 33p. Dep. NTIS $4.75.

From nuclear science symposium; Washington, District of Columbia, USA (11 Dec 1974).

A fission counter was built and successfully tested for operation at 750°F and gamma dose rates up to 6×10^6 R/hr. Results from gamma and neutron tests were compared with theoretical predictions and used to optimize the performance of the counters. (auth)

14123 (EGG-1183-1652) CHARACTERIZATION EFFORT OF HgI_2 RADIATION DETECTORS BY PULSED LASER TRANSIENT CHARGE INJECTION TECHNIQUE. Cho, Z. H.; Watt, M. K.; Slapa, M.; Schieber, M.; Davies, T.; Schnepple, W.; Randtke, P.; Carlston, R.; Sarid, D. (EG and G, Inc., Goleta, Calif. (USA)). Oct 1974. 9p. (CONF-741213-1). Dep. NTIS $4.00.

From nuclear science symposium; Washington, District of Columbia, USA (11 Dec 1974).

Both space-charge-limited current and space-charge-free current pulses for electron and hole injection in HgI_2 crystals have been observed using the Pulsed Laser Transient Charge Technique. Measurement of trapping times and mobilities for both types of carriers will be made from the pulse shapes. Measured values for the mobilities of both electrons and holes are in good agreement with previous measurements using different techniques. Experimental techniques are described. (auth)

14124 (FEI-415) EFFICIENCY CALCULATION OF STILBENE-CRYSTAL SPECTROMETER IN NON-DIRECTIONAL NEUTRON FIELD. Kazanskii, S. A.; Levchenko, V. M.; Yatsenko, A. M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1973. 32p. (In Russian). INIS.

The calculation of the efficiency of stilbene crystals in a non-directional neutron field is examined. A formula is obtained for finding the efficiency of cylindrical stilbene crystals in random mono-directional neutron fields. A computer program for the calculation of the efficiency is given. The calculated values of the efficiency for stilbene crystals of different dimensions are given in an appendix. (tr-auth)

14125 (IFVE-ORZ-73-19) MEASUREMENTS OF BACKSCATTERING OF CHARGED PARTICLES. Grigor'ev, V. A.; Kimel, L. R.; Britvich, G. I.; Lebedev, V. N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 9p. (In Russian). INIS.

A method for the measurement of the backscattering of charged particles using a ring counter is described. The results of the measurement of the backscattering from shields filled with polyethylene, Fe, and Pb are reported for different thickness of the absorber and different distances between the ring counter and the absorber. (tr-auth)

14126 (ITEF-45) ELECTRON-PHYSICAL EQUIPMENT WITH PRECISE REFERENCE IN NANOSECOND RANGE FOR EXPERIMENTS WITH USAGE OF SCINTILLATION COUNTERS. Barkov, B. P.; Katinov, Yu. V.; Sutormin, A. I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1973. 46p. (In Russian). INIS.

An electronics system intended mainly for creating an electronic logic having a large number of selection criteria in experiments where an increased time of resolution is specified in scintillation counting systems is described. (tr-SJR)

14127 (JINR-3-7630) NEUTRON BEAM MONITOR FOR THE PERIODIC PULSE NEUTRON SOURCES. Deme, Sh.; Kim En Ir; Nad, D.; Nazarov, V. M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1973. 13p. (In Russian). INIS.

A method is described for the relative monitoring of neutrons of every spectrum (with the exception of thermal neutrons) in a pulsed periodic source. The long-term stability of the measurement is guaranteed by the continuous comparison of the reading from the pulsed source with readings from stable Pu-Be sources. The parameters necessary for optimization of the measurement are calculated and the monitor parameters are reported. (tr-auth)

14128 (JINR-13-7238) COUNTER WINDOW EFFECT ON THE ENERGY RESOLUTION OF Si SURFACE BARRIER DETECTORS. Golovin, B. M.; Permyakova, L. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1973. 15p. (In Russian). INIS.

The energy losses of particles in the inlet window of Si surface-barrier detectors are calculated by the Monte Carlo method. It is shown that the uncertainty in the path length of the particles registered and the fluctuations of the energy loss in the inlet window of the semiconductor detector essentially limits the attainable characteristics of these devices. (tr-auth)

14129 (JINR-P13-8188) CONSTRUCTION AND CHARACTERISTICS OF A PROPORTIONAL CHAMBER OF 900×300 mm^2 WORKING AREA. Astabatyan, R. A.; Zanevskii, Yu. V.; Novikov, E. A.; Peshekhonov, V. D.; Uralskii, D. V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1974. 14p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Construction of one-coordinate proportional chambers of 900×300 mm^2 working area is described, and characteristics obtained under laboratory conditions using a β-source are presented. (auth)

14130 (LA-UR-74-1888) FABRICATION AND X-RAY CALIBRATION OF THIN PLASTIC SCINTILLATORS. Lyons, P. B.;

Lier, D. W. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 6p. (CONF-741212-6). Dep. NTIS $4.00.

From 14th scintillation and semiconductor symposium; Washington, District of Columbia, USA (11 Dec 1974).

Thin film plastic scintillator detectors were fabricated and calibrated with x rays in the 1.5 to 20 keV range. The calibration systems used are described. Measurements showed that the presence of a film substrate can significantly change the detector response. X-ray conversion efficiency was determined as a function of energy and shown to be a strong function of energy for low energy x rays. (auth)

14131 (LBL-3342) MULTIWIRE PROPORTIONAL CHAMBERS IN NUCLEAR MEDICINE: PRESENT STATUS AND PERSPECTIVES. Perez-Mendez, V.; Kaufman, L.; Powell, M. R.; Price, D. C.; Blumin, L.; Cavalieri, R. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Sep 1974. Contract W-7405-eng-48. 16p. (CONF-740926-4). Dep. NTIS $4.00.

From 1st world congress of nuclear medicine and exhibition meeting; Tokyo, Japan (30 Sep 1974).

The construction and operating characteristics of xenon-filled multiwire proportional chambers (MWPC) for nuclear medicine imaging are described. The resolution and image quality of these devices are demonstrated by various images taken with γ rays ranging in energy from 28 to 140 keV. From some measurements done with a 4 atmosphere chamber, it is estimated that 10 atmosphere xenon-filled chambers could provide a satisfactory combination of resolution (2 mm) and detector efficiency for use with γ rays in this energy range. (auth)

14132 (LYCEN-7342) LIFETIME MEASUREMENT USING A REAL TIME DIGITAL CORRELATOR. Daniere, J.; Rougny, R.; Descroix, E.; Charnay, D.; Billerey, R.; Chevalier, H. (Lyon-1 Univ., 69-Villeurbanne (France). Inst. de Physique Nucleaire). Jul 1973. 22p. (In French). Dep. NTIS (US Sales Only) $4.25.

A digital correlator giving the autocorrelation or the intercorrelation function of two signals X(t) and Y(t) in true time is used. The incremental delay is adjustable between 100 nsec and 1 sec by 100 nsec steps. The application of this correlator to nuclear spectroscopy is studied. Other methods used for nuclear lifetime determination are compared. (FR)

14133 (TNO-RD-I-7311-132) GENERALIZATION OF A COMPUTER PROGRAM FOR WHOLE-BODY COUNTER RESPONSE CALCULATION. van de Vusse, E. (Gezondheidsorganisatie TNO, Rijswijk (Netherlands). Radiobiologisch Instituut TNO). 1973. 50p. (In Dutch). INIS.

Some corrections have been made in an existing computer program (FORTRAN IV) used for the calibration of a whole-body counting equipment. The program was also used for the calculation of calibration factors for the determination of ^{40}K in children. (INIS)

14134 (UCRL-75714) SCINTILLATION RESPONSE OF A SINGLE LITHIUM FLUORIDE CRYSTAL. Kloepping, R. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 21 Nov 1974. 5p. (CONF-741212-2). Dep. NTIS $4.00.

From 14th scintillation and semiconductor symposium; Washington, District of Columbia, USA (11 Dec 1974).

Lithium fluoride (activated) crystals were prepared by the Bridgeman-Stockbarger and Czochralski methods. Measurements have been made on the scintillation response of a LiF crystal to photon energies between 8 and 1333 keV. The tissue dose in rads was calculated and compared to the response of the LiF crystal over the same energy range. The response of a single titanium-activated LiF crystal was compared to the response of a NE 109 air-equivalent scintillator at ^{60}Co energies. The absorption and emission spectra of the LiF crystal were obtained. (auth)

14135 (UCRL-76274) BEST LINEAR DECODING OF RANDOM MASK IMAGES. Woods, J. W.; Ekstrom, M. P.; Palmieri, T. M.; Twogood, R. E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 Dec 1974. 7p. (CONF-741212-5). Dep. NTIS $4.00.

From 14th scintillation and semiconductor symposium; Washington, District of Columbia, USA (11 Dec 1974).

In 1968 Dicke proposed coded imaging of x and γ rays via random pinholes. Since then, many authors have agreed with him that this technique can offer significant image improvement. A best linear decoding of the coded image is presented, and its superiority over the conventional matched filter decoding is shown. Experimental results in the visible light region are presented. (auth)

14136 CHOICE OF POSITION OF THE OPERATING POINT ON THE DISCRIMINATION CHARACTERISTIC CURVE OF A THERMAL NEUTRON RADIOMETER. Goloshchapov, N. M.; Kuz'minykh, M. K.; Tsenter, E. M. Meas. Tech. (USSR) (Engl. Transl.); 17: No. 5, 743-745(May 1974).

Translated from Izmer. Tekh.; 17: No. 5, 61-62(May 1974).

Radiometers with scintillation or gas-discharge thermal neutron detectors frequently are used for the certification of neutron sources. These detectors also record γ quanta in addition to neutrons. Usually, the operating point on the discrimination characteristic curve of the radiometer (the working value of the discrimination level) is chosen where the count rate is still relatively large when recording neutrons but when recording γ quanta it does not exceed a few percent of the neutron count rate. With this level of discrimination, it is assumed that the position of the operating point on the characteristic curve is chosen correctly and that it remains invariable, independently of the type of neutron source. However, in practice, the sources for certification and standardization frequently differ in the external output of neutrons and γ quanta, which may appear as the main cause of distortions in the radiometer readings. In order to recognize these distortions, a statistical method of analysis is proposed for the counter characteristic discrimination curve of the radiometer. (WHK)

14137 FLUORESCENCE RISETIME OF NE 102 SCINTILLATOR. Campillo, A. J.; Hyer, R. C.; Shapiro, S. L. (Los Alamos Scientific Lab., N. Mex. (USA)). Nucl. Instrum. Methods; 120: No. 3, 533-534(15 Sep 1974).

NE 102 is excited with picosecond pulses at 0.353 μm, and the onset of fluorescence is detected with a streak camera. The risetime of the fluorescence is measured to be $\leq$20 ps. (auth)

14138 A POSITION-SENSITIVE SEMI-PROPORTIONAL CHAMBER FOR ULTRA-SOFT X-RAYS. Auriemma, G.; Giovannelli, F.; Mastropietro, M.; Ubertini, P. (Consiglio Nazionale delle Ricerche, Frascati (Italy). Lab. di Astrofisica Spaziale). Nucl. Instrum. Methods; 120: No. 3, 497-500(15 Sep 1974).

A straightforward approach to the problem of obtaining position measurements from a soft x-ray (0.1 to 6 keV) proportional counter is presented. The characteristics of the chamber and the noise degradation of the spatial resolution at lower energies are discussed. (auth)

14139 EFFECTIVE SOLID ANGLE OF DETECTING ^{8}Be NUCLEI WITH A DUAL DETECTOR SYSTEM. Schimizu, J.; Fujii, K.; Takimoto, K.; Muto, J. (Kyoto Univ. (Japan). Dept. of Physics). Nucl. Instrum. Methods; 120: No. 3, 529-531(15 Sep 1974).

Calculated effective solid angles of a dual detector system are compared with those derived from the measurement of the reaction $^{10}B(d,^{8}Be(g.s.))^{4}He$, and they are in good agreement. (auth)

14140 A NEW METHOD FOR MONITORING THE THRESHOLD OF A LARGE NEUTRON SCINTILLATION COUNTER. Christ, A.; Noeldeke, G.; Nuding, W.; Reichelt, T. (Bonn Univ. (F.R. Germany). Physikalisches Inst.). Nucl. Instrum. Methods; 120: No. 3, 527-528(15 Sep 1974).

The dependence of the β-counting rate of a ^{90}Sr-source on the discriminator threshold of a large neutron counter has been used to continuously monitor the stability of the threshold during experiments. (auth)

14141 DETECTOR OF RADIOACTIVITY AT THE OUTPUT OF A GAS CHROMATOGRAPH. Barnov, V. A. pp 71-94 of Yaderno-Khimicheskie Yavleniya v Tverdykh Telakh. Tsetskhladze, T. V. (ed.). Tbilisi, USSR; Izdatel'stvo Metsniereva (1973). (In Russian).

Different fields of radiochromatography application are considered. It is shown that for most widely used radioisotopes of hydrogen and carbon it is most expedient to use the internal filling gas flow radiation detector. Different relations are given permitting the influence of different parameters of gas-chromatographic experiments on the operation of gas flow detectors to be determined. A radiochromatograph is described which permits the operation of the flame-ionization detector and the gas flow detector at the same time. A protection system for the detector from external radiation and cosmic ray background as well as from miscalculations allows the background of the detector to be decreased. In addition, a review on radiation detectors at the exit of a gas chromatograph is given. (44 references) (auth)

14142 CONTENTS OF RADIUM, URANIUM, RADIOTHORIUM, AND THORIUM IN SOME SCINTILLATORS. Severnyi, S. A. Kosm. Luchi; No. 14, 162-164(1974). (In Russian).

The influence of detector contamination by radioactive elements on the accuracy of low-intensity emission recordings is examined. Methods of controlling contamination are discussed. (IAA)

14143 EMPLOYMENT OF RECENT SEMICONDUCTOR ELEMENTS FOR RADIATION MEASUREMENT IN ANALYSIS MEA-

SUREMENT TECHNOLOGY. Neff, H. (Siemens AG, Karlsruhe, Ger.). Arch. Tech. Mes. Messtech. Praxis; No. 463, R124-R129 (Aug 1974). (In German).

The physical principles of radiation measurements are discussed along with the characteristics of the semiconductor detectors and photodiodes which are employed in the measurements. Attention is given to surface barrier detectors, p-i-n diodes, and avalanche diodes. The Si(Li) semiconductor detector and its use for the measurement of ionizing radiation is considered, taking into account the principles of operation and the simultaneous determination of photon number and photon energy. Structural details concerning semiconductor detectors and photodiodes used for radiation measurements are shown. Difficulties connected with fluctuations of detector capacitance and momentum characteristics are overcome by employing a charge-sensitive preamplifier. The advantages obtained by using avalanche photodiodes in place of photomultipliers are investigated. (IAA)

14144 METHOD FOR DATA REDUCTION AT ENERGY-LIFETIME MEASUREMENTS. Bartsch, H.; Huber, K.; Kneissl, U.; Sattler, H. (Giessen Univ. (F.R. Germany). Strahlenzentrum). Nucl. Instrum. Methods; 121: No. 1, 185-189(1 Oct 1974).

A data reduction method for two-parameter measurements is described. Contracting the time range by using a ^{2}log time scale enables energy- and time measurements in large energy and time ranges with conservation of the relative precision. The method is used to investigate isomeric states with half-lives in the μs and ms region, which are excited by a pulsed bremsstrahlung beam. The method is discussed and its application to measurements on the isomers ^{88m1}Y ($E\gamma$ = 392.5 keV, $T_{½}$ = 300 μs) and ^{88m2}Y ($E\gamma$ = 442.3 keV, $T_{½}$ = 14.2 ms) is demonstrated. (auth)

14145 SIGNAL LOCATION BY SHORTED RC LINE. Mathieson, E.; Evans, K. D.; Parkes, W.; Christie, P. F. (Leicester Univ. (UK)). Nucl. Instrum. Methods; 121: No. 1, 139-149(1 Oct 1974).

An attempt is made to describe analytically the characteristics of the system comprising uniform RC line, charge-sensitive terminal amplifiers and waveform shaping filters, as used in the rise-time mode for the location of injected charge signals for readout of position-sensitive photon and particle detectors. The measured performance of a resistive sheet miniature line and of a discrete component line are compared with theoretical prediction. (auth)

14146 HIGH RESOLUTION POSITION-SENSITIVE DETECTORS USING MICROCHANNEL PLATES. Parkes, W.; Evans, K. D.; Mathieson, E. (Leicester Univ. (UK)). Nucl. Instrum. Methods; 121: No. 1, 151-159(1 Oct 1974).

Requirements are identified for position-sensitive detectors for use at lower quantum energies and better position resolution than can be realized using present gas and silicon event-to-charge converters. The capabilities of microchannel plate converters for use in such applications are discussed. Measured performance data are presented for a variety of practical systems. Position uncertainty of 18 μm over a linearly resolved field of 18 mm is demonstrated. (auth)

14147 AUTOMATED DATA-COLLECTION AND ANALYSIS SYSTEM FOR ASSAY OF WHOLE-BODY RADIOACTIVITY AND LUNG BURDENS. Watts, J. R. (Du Pont de Nemours (E.I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Nucl. Instrum. Methods; 121: No. 1, 91-95(1 Oct 1974).

Simultaneous total-body burdens of fission products and/or induced activities and lung burdens of transuranic radionuclides are routinely measured using a computer-based pulse-height analyzer connected to two sets of scintillation detectors. The pulse-height-analyzer code and the data-analysis code are in the computer memory. After a preset counting time, the analysis program requests the operator to input information by Tele-type equipment for identification of the person being counted. The permanent record of each measurement is printed at the end of the analysis and supplies a data summary and status of radioactivity in the subject. (auth)

14148 WALK AND DISPERSION IN LEADING-EDGE TIMING WITH PLANAR SEMICONDUCTOR GAMMA RAY DETECTORS. El-Ibiary, M. Y. (Cairo Univ. (Egypt). Faculty of Engineering); El-Kharadly, L. A. (Cairo Univ., El Mansura (Egypt). Faculty of Science). Nucl. Instrum. Methods; 121: No. 1, 49-53 (1 Oct 1974).

A compact formula for calculating the walk of leading-edge timing in a planar semiconductor gamma ray detector system is given together with a procedure for computing the time resolution in terms of the primary parameters of the system components. Comparison with experimental results published elsewhere shows close agreement. (auth)

14149 CHARACTERISTICS OF A HIGH-PURITY GERMANIUM DETECTOR. Thomas, G. E. (Argonne National Lab., Ill. (USA)); Pehl, R. H. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Nucl. Instrum. Methods; 121: No. 1, 65-67(1 Oct 1974).

A high-purity Berkeley germanium detector is in use at the Argonne CP-5 reactor. This detector has been transported at room temperature, temperature-cycled many times to remove surface contamination, and remains an excellent device with a resolution of 4.7 keV at 10.8 MeV which corresponds to a Fano factor of 0.12. (auth)

14150 DIRECTIONAL ANISOTROPY IN ORGANIC SCINTILLATION CRYSTALS. Brooks, F. D.; Jones, D. T. L. (Cape Town Univ. (South Africa). Dept. of Physics). Nucl. Instrum. Methods; 121: No. 1, 69-76(1 Oct 1974).

The scintillation pulse height responses and scintillation pulse shape discrimination (PSD) properties of anthracene crystals have been investigated for protons at six different energies in the range 1 to 22 MeV. Similar investigations were made for stilbene, terphenyl and quaterphenyl crystals at 8 MeV and for stilbene and naphthalene crystals at 22 MeV. The pulse height and PSD responses were investigated as a function of proton direction using recoil protons released within the crystals by monoenergetic incident neutrons. The pulse height anisotropy of anthracene crystals varies from 33% at 1 MeV to 8% at 22 MeV. The pulse height anisotropies of the other crystals are similar to that of anthracene at the same energy. The PSD anisotropy of anthracene expressed as a percentage of the PSD dispersion between Compton electrons and recoil protons varies from 3% at 1 MeV to 92% at 22 MeV. The PSD anisotropy of naphthalene is about half that of anthracene at 22 MeV and the PSD anisotropies of the other crystals are 3 to 7 times smaller than that of anthracene at 8 MeV. The pulse height and PSD anisotropies of anthracene are consistent with a model which assumes that the transfer of excitation energy during the scintillation process occurs preferentially in directions lying within the ab-planes of the crystal lattice. (auth)

14151 A SCINTILLATION POLARIMETER FOR N-P SCATTERING STUDIES. Brooks, F. D.; Jones, D. T. L. (Cape Town Univ. (South Africa). Dept. of Physics). Nucl. Instrum. Methods; 121: No. 1, 77-85(1 Oct 1974).

A neutron polarization analyzer is described in which the direction dependence of the scintillation pulse shape discrimination (PSD) properties of an anthracene crystal provide the basis for observing the left-right asymmetry of recoil protons associated with the n-p scattering of monoenergetic neutrons within the crystal. The polarimeter consists of a single anthracene crystal mounted on a magnetically shielded photomultiplier tube which is fitted with a PSD circuit. The pulse height and PSD outputs from the photomultiplier are analyzed in two parameter mode and a set of observations consisting of a pair of two-parameter spectra leads to a measurement of the recoil proton asymmetry as a function of recoil angle. The polarization in n-p scattering is then deduced as a function of centre-of-mass scattering angle θ_{cm} for values of θ_{cm} in the range 50°-180°. (auth)

14152 CALCULATIONS OF THE RESPONSE OF MOXON-RAE DETECTORS FOR NEUTRON CAPTURE CROSS-SECTION MEASUREMENTS. Iyengar, K. V. K.; Lal, B.; Jhingan, M. L. (Tata Inst. of Fundamental Research, Bombay (India)). Nucl. Instrum. Methods; 121: No. 1, 33-39(1 Oct 1974).

For measurements of (n,γ) cross sections at low neutron energies, a Moxon-Rae detector is more suitable than the conventional liquid-scintillators. This detector consists of an electron converter and a thin plastic scintillator, and is required to have an "efficiency per MeV of incident γ-rays" independent of γ-ray energy. Detailed Monte-Carlo calculations have been carried out to investigate the proper composition and thickness of the electron converter to be used for an ideal Moxon-Rae detector. Among the elements studied Mo, Ni, and Sn exhibit nearly ideal response in the energy range 2 to 12 MeV; Bi_2O_3 also exhibits a reasonably uniform response over this energy range. The mixture of C + Bi_2O_3 in the ratio of 50 atoms of C and 10 molecules of Bi_2O_3 gives a good response in the energy interval 1 to 12 MeV. The dependence of the response on the parameters of a concentric annular groove on the surface of cylindrical converters was investigated to improve the response at energies below 1 MeV. The results indicate that it is not realizable. (auth)

14153 ALPHA HAND AND FOOT MONITOR (3 MAR 1970) (ENGINEERING MATERIALS). (California Univ., Livermore (USA). Lawrence Livermore Lab.). (CAPE-2401).

8 drawings.

Drawings are included for (1) assembly and wiring, alpha probe with grill; (2) housing, alpha probe; (3) front insulator; (4) back insulator; (5) glass frame, cast; (6) grill wire, assembly; (7) assembly, grill frame; and (8) frame (sand casting). (WHK)

14154 RADIATION DETECTOR BASED ON THE TRANSVERSE DEMBER EFFECT IN ANISOTROPIC SEMICONDUCTORS. Zhad'ko, I. P.; Romanov, V. A.; Yurov, Yu. G. (Inst. of Semiconductors, Kiev). Poluprov. Tekh. Mikroelektron.; No. 15, 71-79(1974). (In Russian).

A new type of detector using the transverse Dember effect as it appears in semiconductors with a natural anisotropy is proposed. The basic theory of the Dember effect is detailed, and calculations for the response and sensitivity of such detectors are worked out. The proper choice of working material is discussed, and the construction of a detector from hole-type specimens of p-CdSb is described. (IAA)

14155 PROBLEMS IN CALIBRATING INSTRUMENTS FOR ENVIRONMENTAL GAMMA EXPOSURE DOSE MEASUREMENTS. Jagielak, J.; Gwiazdowski, B.; Pensko, J.; Zak, A. (Central Lab. for Radiological Protection, Warsaw). pp 337-349 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); CONF-731117-(P1).

The problems in calibrating instruments for the measurement of gamma background dose rate from natural and artificial radioactive isotopes in the environment are discussed. In the Central Laboratory for Radiation Protection at Warsaw, several methods have been developed that are suitable for identifying and measuring exposure dose due to gamma radiation emitting radionuclides in the environment. High-pressure ionization chambers, GM and scintillation counters for field measurements, and a device that continuously records the dose rate are at present in use. The characteristics of the detectors require that special care is taken with calibration techniques and procedures. For calculation of calibration factors for these instruments three types of measurement geometry have been assumed: isotropic distribution of the radiation source; infinite plane radiation source; and combination of planar and isotropic distributions. The comparison of calibration factors obtained theoretically for the various types of instruments are discussed and confirmed experimentally. (auth)

14156 NEW LOW-BACKGROUND COUNTING FACILITY FOR INSTRUMENT CALIBRATION. Abe, S. (National Inst. of Radiological Sciences, Chiba, Japan). pp 351-358 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); CONF-731117-(P1).

Various types of radiation instruments are used for measuring low levels of radiation in the field and in environmental surveillance programmes. These instruments are generally calibrated at radiation levels as high as 100 times the natural background in order to reduce the effect of background radiations. However, radiation levels normally measured by these instruments differ little from natural background levels. The discrepancy between calibration and measurement levels produces difficulties in assessing and assigning a level of uncertainty to the measurements. A low-background facility has been planned to overcome these difficulties, and details of its constructional philosophy and practical requirements are presented. The room, which is underground, will also prove useful for studying and checking the low-level measurement behavior of various instruments. The aim is to achieve an overall background in the low-background room of one hundredth of the natural level at the ground surface. (auth)

14157 SOLID-STATE DETECTOR FOR CONTINUOUS RADIOACTIVITY MONITORING OF AN ADVANCING RADIOACTIVITY CARRIER. Sorejs, O.; Vasek, T. Czech Patent 148235. 31 May 1972. 6p. (In Czech).

A solid-state detector is described suitable for 2π or for 4π activity monitoring, consisting of a hollow supporting body in whose measuring cavity or around it, outside the hollow body, one or more solid-state detectors are placed. The detectors are in the form of a quartz plate with the inner semiconducting detection layer adapted to the shape of the measuring cavity through which the activity carrier advances. The invention may be applied in determining and measuring alpha, beta, and gamma radiation, mainly of beta radiation in radiochromatography, amino-acid analysis, the analysis of nucleic acids and their hydrolysates, in measuring the radioactivity of waste water or powder materials, in activity measurement and dosimetry of gases, and in all cases where the measurement or monitoring of radioactivity and its continuous analysis are needed. (INIS)

14158 THE NEW ROLE OF SCINTIGRAPHS IN WHOLE BODY COUNTING TECHNIQUES. Chomicki, O. A. (Centrum Medyczne Kształcenia Podyplomowego, Warsaw (Poland)). Postepy Fiz. Med.; 7: 189-195(1972). (In Polish).

A review is given of the parallel development of clinical whole-body counting and scintigraphy, the latter having followed the exponential law. The present trend seems to be for whole-body counting to incorporate to a much greater extent the localized measurements and, therefore, overlap the whole-body rectilinear scanning methods. At the same time, new high-sensitivity commercial scanners can be used as whole-body counters because of the use of large 5-in.-diam. × 3-in.-thick NaI(Tl) crystals. By adding inexpensive shielding (a collimator or a low-background room), activities of the order of nanocuries can be measured. The method of a low-cost whole-body scanner-type installation seems to be particularly appropriate in places where the high cost of whole-body counters prevents them being used on a larger scale. (auth)

Radiation Dosimeters

Refer also to abstract 15651.

14159 (CEA-CONF-2743) AUTOMATIC RAPID READING SYSTEM FOR THERMOLUMINESCENT PERSONNEL DOSIMETERS. Portal, G.; Blanchard, P.; Prigent, R.; Chenault, R. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). [nd]. 8p. (CONF-740833-4). Dep. NTIS (US Sales Only) $4.00.

From 4th international conference on luminescence dosimetry; Krakow, Poland (27 Aug 1974).

The dosimeter contains four sintered discs of pure lithium fluoride which can be reused without annealing. Using four different sintered discs, it is possible to obtain data on x-ray radiation energy, on its effect, and on the doses absorbed due to thermal neutrons. The "box" is equipped with an automatic identification system. The reader was designed for good reliability, and the main parameters (temperature, electronic characteristics, etc.) are systematically monitored after each measurement, the results being printed on official documents. The heat treatment system employed permits the use of a highly rapid reading cycle. The four discs of a dosimeter are read simultaneously in about 7 seconds. The same reader may be employed for a device containing up to 6 radiothermoluminescent discs, subject to minor modifications. (auth)

14160 (CEA-CONF-2744) SENSITIVITY OF VARIOUS RTL AND RPL MATERIALS TO THERMAL NEUTRONS. Spurny, F.; Portal, G. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Service Technique d'Etudes de Protection et de Pollution Atmospherique). [nd]. 18p. (CONF-740833-5). Dep. NTIS (US Sales Only) $4.00.

From 4th international conference on luminescence dosimetry; Krakow, Poland (27 Aug 1974).

The good correspondence between the theoretical and experimental results shows that it is possible to calculate the sensitivity to thermal neutrons of the various luminescent materials (radiophotoluminescent or radiothermoluminescent), allowing for the conditions of their use in dosimeters (dimension, composition, etc.). It is shown that, contrary to the observations of previous work, calcium sulfate activated by 0.1 mol % of dysprosium is one of the materials least sensitive to thermal neutrons. These results show that in the presence of thermal neutrons it is preferable to use alumina or calcium sulfate according to requirements, since ^{7}LiF, even free of any trace of ^{6}Li, would be more sensitive. Now, commercial products always comprise an infinitesimal quantity of ^{6}Li which increases the sensitivity to thermal neutrons in very variable proportions, thereby increasing the errors. The analysis of the results for the materials containing ^{6}Li has enabled an estimate to be given of the relative radiophotoluminescent or radiothermoluminescent efficiencies for the heavy particles emitted during the $^{6}Li(n,\alpha)^{3}H$ reactions; these are respectively equal to 0.3 and 0.2 for LiF and the Pb 33 glasses. (auth)

14161 (CEA-CONF-2745) SOME DOSIMETRIC PROPERTIES OF Al_2O_3 USING EXOELECTRONS. Holzapfel, G.; Petel, M.; Rodiere, M. (Physikalisch-Technische Bundesanstalt, Braunschweig (F. R. Germany); Physikalisch-Technische Bundesan-

stalt, Berlin (F. R. Germany); CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). [nd]. 10p. (CONF-740833-3). Dep. NTIS (US Sales Only) $4.00.

From 4th international conference on luminescence dosimetry; Krakow, Poland (27 Aug 1974).

Different α-Al_2O_3 products exhibit corresponding TSEE spectra with well separated peaks around 250°C and 450°C. Establishing stable reading conditions in the CH_4 GM-counter and incorporating the Al_2O_3 particles of minimum size (< 10 um) in graphite results in a linear TSEE response for both peaks with 2% standard deviation for single detectors and 10% for intragroup detectors. The dose ranges cover 3.10^{-2} to 8.10^{2} rads β-irradiation from ^{90}Sr. With a dominating 450°C peak, Merck material can be applied up to 400°C irradiation temperature. Equal sensitivities of the 250°C and the 450°C peaks of the Degussa material enable dose information storage in the 450°C peak, but with a reaction of the accumulated dose on the 250°C reading. Multireadings can be taken from decaying OSEE of Merck material with a linear response over 3 decades and doses exceeding some rads. (auth)

14162 (CONF-741219-2) INTEGRATING DOSIMETERS FOR ENVIRONMENTAL RADIATION ASSESSMENT. Becker, K. (Oak Ridge National Lab., Tenn. (USA)). 1974. 13p. Dep. NTIS $4.00.

From first Asian regional congress on radiation protection; Bombay, India (15 Dec 1974).

Integrating solid-state dosimeters for long-term environmental (background) radiation measurements have to be more sensitive and stable than dosimeters for personnel monitoring. Their photon energy response, on the other hand, is less important. Several TLD phosphors such as $CaSO_4$: Dy or Mg_2SiO_4: Tb meet the requirements well. International intercomparisons have been organized for comparing the performance of different systems under field conditions. Special studies included an attempt to determine the environmental dose-rate averaged over hundreds or thousands of years by TL measurements on ancient pottery of known age. General problems in assessing the actual population exposures to background radiation are discussed briefly. (auth)

14163 (EPA-520/5-73-006) COMPARISON OF CaF_2: Mn AND LiF THERMOLUMINESCENT DOSIMETERS FOR ENVIRONMENTAL RADIATION MONITORING. Partridge, J. E.; Windham, S. T.; Eakins, J.; Lochamy, J. (Environmental Protection Agency, Washington, D. C. (USA). Office of Radiation Programs). Dec 1973. 14p.

Two types of thermoluminescent dosimeters, commonly used for environmental radiation monitoring, were evaluated and compared. The study consisted of approximately four months of field evaluation as part of a pre-operational survey at a nuclear power plant. The evaluation consisted of comparing the average μR/hr readings obtained at each of eight sites for the period of the study. The precision of reproducibility for both systems was determined to be approximately 3%. The difference in the average μR/hr readings for the two systems ranged from 16% to 30% at the various sites. (auth)

14164 (EPA-520/5-73-007) INTEGRATING DEVICE FOR USE WITH PRESSURIZED IONIZATION CHAMBERS. Windham, S. T.; Partridge, J. E.; Kelley, H. L. (Environmental Protection Agency, Washington, D. C. (USA). Office of Radiation Programs). Dec 1973. 11p.

A low-cost, commercially available electronic integrator has been adapted for use with the Reuter-Stokes Model RSS-111 pressurized ionization chamber. The integrator provides a readout of the total exposure accumulated during the integration period. This precludes the necessity of manually integrating the area under a lengthy strip chart curve. Use of the integrator with the RSS-111 is quite simple and requires no major modification of the ionization chamber. Field and laboratory tests of the integrator have shown it to produce consistent results over both short and long integration times, and at both high and low exposure rates. (auth)

14165 (RT/PROT-74-1) SOME PROPERTIES AND PRACTICAL APPLICATIONS OF SINTERED BERYLLIUM OXIDE AS THERMOLUMINESCENT MATERIAL IN RADIATION DOSIMETRY. Benincasa, G.; Ceravolo, L.; Scarpa, G. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). 1974. 16p. INIS.

The main dosimetric characteristics of ceramic undoped beryllium oxide as a thermoluminescent material have been investigated. In the dosimetry of x- and γ-rays some advantages of BeO over other TL materials are low cost, chemical inertness, resistance to mechanical shocks, high sensitivity, good reproducibility of response, low fading, absence of low temperature peaks and mode rate energy dependence. In the dosimetry of mixed fields of neutrons and gamma radiation, beryllium oxide could be very useful for measuring the gamma component with reasonable accuracy. The possible use of BeO discs as portal dosimeter in dose intercomparison has also been studied. In this connection beryllium oxide Thermalox 995 discs have been used in the second dose intercomparison organized by EULEP. (INIS)

14166 A CALORIMETRIC RADIATION DOSIMETER FOR AN ACCELERATOR ENVIRONMENT. Lambert, K. P.; Van de Voorde, M. H. (European Organization for Nuclear Research, Geneva (Switzerland)); Doke, T. (Waseda Univ., Tokyo (Japan). Science and Engineering Research Lab.); Inada, T. (National Inst. of Radiological Sciences, Chiba (Japan)). Nucl. Instrum. Methods; 120: No. 3, 501-508(15 Sep 1974).

The main concepts of absorbed radiation dose calorimatry are discussed followed by the description of a calorimeter capable of measuring absorbed doses from 2.0×10^2 to 2.0×10^5 rad in an accelerator radiation environment. (auth)

14167 CONVERSION OF IONIZATION MEASUREMENTS TO ABSORBED DOSES IN THE DOSIMETRY OF HIGH-ENERGY RADIATION BEAMS. Rytina, K. (Ceskoslovenska Akademie Ved, Prague. Ustav Fyziky Plazmatu). Cesk. Radiol.; 28: No. 1, 61-68(Jan 1974). (In Czech).

The problems are discussed of converting dosimetric values obtained by ionization chamber measurements to terms of doses absorbed in the site of irradiation. Applying the results of various studies by other authors in the spectral composition of primary and secondary electrons during their passage through the irradiated medium, conversion factors are determined for electron beams with an energy of up to 40 MeV. The dependence of the conversion factors on energy and the depth in a water phantom is shown graphically. An example is given of the effect of the mentioned correction on the depth-dose curve. (auth)

14168 QUANTITATIVE UPTAKE MEASUREMENTS WITH A SHADOW SHIELD WHOLE-BODY COUNTER. Blake, K. C. H.; Hering, E. R. (Groote Schuur Hospital, Cape Town (South Africa). Dept. of Bio-Engineering and Medical Physics; Cape Town Univ. (South Africa)). S. Afr. Med. J.; 47: 1066-1068(23 Jun 1973).

7 refs.

A simple procedure is described for the calibration of a shadow shield whole-body monitor to determine the absolute amount of a radioisotope at various body sites of a patient. (auth)

14169 PHOTOGRAPHIC EMULSIONS AND THEIR APPLICATION IN DOSIMETRY. Marinello, G.; Sliwinski, C. (Hopital Henri-Mondor, Creteil, France). J. Radiol., Electrol., Med. Nucl.; 55: No. 6, 507-513(Jun 1974). (In French).

A certain number of photographic emulsions were selected and their varying response to the dose received, the conditions of development, and their position in the phantom were studied. The amount of Cherenkov radiation for an electron beam of 31 MeV passing through a white polystyrene phantom according to the type of emulsion was assessed, and the effect of the luminescence of the air when the naked films were irradiated on the surface of this phantom was studied. Photographic emulsions and ionization chambers were compared and some of their main applications discussed: checking the position and homogeneity of high energy beams, calculating graphs of in-depth yield, and studying the distribution of the dose in a tissue-equivalent medium, on the inner surfaces of two mediums, and under masks. (FR)

14170 RADIATION MONITORING OF URANIUM MINERS: A COMPARISON OF THE KUSNETZ, TLD, AND BIOASSAY DETERMINATIONS OF CURRENT EXPOSURES. Savignac, N. F. Fort Collins, CO; Colorado State Univ. (1974). 53p. University Microfilms Order No. 74-27,960.

Thesis (Ph. D.).

A comparison of the Kusnetz, TLD, and bioassay determinations of current exposures for uranium miners was conducted to ascertain the practicality of each monitoring method for use in the uranium mine industry. The Kusnetz method was considered superior to the other two methods although it was subject to possible selective air sampling procedures. The TLD system is a potentially expensive monitoring system and is not recommended at its current stage of development due to the limited durability of the air pumps. The ^{210}Pb in whisker bioassay system provided better determination of exposure than did the ^{210}Po in whisker system but the variable sources of ^{210}Pb affect the correlations between ^{210}Pb in biological samples and exposures from short-lived radon daughters. Dependent on the residence time of mine ventilation air, the short-lived daughters can contribute 6 to 75% of the total ^{210}Pb intake per working level month, ^{210}Pb in the ventilation air 0 to 94%, and ^{222}Rn 0 to 75%. Leakage of old mine air into the ventilation air streams increases the

percentage of ^{210}Pb in the ventilation air at the expense of the other two sources. The percentage of ^{210}Pb atoms per working level month to ^{218}Po atoms per working level month is constant for ventilation air of less than approximately 15 minutes residence time and for ventilation conditions where a minimum of old mine air blends into the ventilation air streams. Bioassay systems based on ^{210}Pb would overestimate the hazards associated with ^{218}Po atoms under other ventilation conditions. (Diss. Abstr. Int., B)

14171 THE SPACE-CHARGE DOSIMETER. General Principles of a New Method of Radiation Detection. Holmes-Siedle, A. (Reading Univ. (UK). J. J. Thomson Physical Lab.). Nucl. Instrum. Methods; 121: No. 1, 169-179(1 Oct 1974).

When dielectrics under a high field are exposed to high-energy radiation, carriers are separated and space charge results. The change in potential at the dielectric surface can be measured non-destructively and such a change is initially linear with radiation dose. This provides a principle for radiation dosimetry not previously exploited, here named space-charge (SC) dosimetry. One compact, direct-reading form, based on the metal-oxide-semiconductor (MOS) transistor, is described and the principles for improving this form by orders of magnitude are set out. The present level of sensitivity measuring a fraction of a rad (SiO_2) is well adapted for use in radiology, beam diagnostics, space radiation monitoring and other applications requiring close-spaced integrating dosimeters. With development, the method could be used in personnel radiation monitoring. (auth)

14172 NEUTRON DOSIMETRY WITH SOLID-STATE DETECTORS. Chaudhri, M. A. (University of Islamabad, Islamabad, Pakistan); Forse, G. R. (Hammersmith Hospital, London (UK). M.R.C. Cyclotron Unit). Nucl. Instrum. Methods; 121: No. 1, 191-192(1 Oct 1974).

Polythene-covered silicon surface-barrier detectors have been used successfully for instant dosimetry of neutrons of up to 55 rad/min intensity. Use of a similar device as a cheap, instant in-vivo neutron dosimeter is suggested. (auth)

14173 NEW CHARACTERISTICS FOR CELLULOSE NITRATE FILM AS A NEUTRON RECOIL TRACK DETECTOR. Hassib, G. M.; Medveczky, L. (ATOMKI, Debrecen, Hungary). ATOMKI (At. Kut. Intez.) Kozlem.; 16: No. 4, 315-324(1974).

The characteristics of the colored cellulose nitrate film "Kodak LR-115" as a neutron recoil track dosimeter with a rad response have been investigated. The present studies are based on the direct interaction of neutrons with the nuclei of the detector materials. Samples of LR-115 film were exposed to different neutron spectra, covering the energy range between 1.4 MeV to 14 MeV, and etched in 10% NaOH at 60°C for different durations. The neutron fluence was measured simultaneously, using a calibrated fission track detector. The variation of the detector sensitivity as a function of neutron energy was investigated. This function matched the rad per unit fluence curve at all energies. On the basis of these results the present detector may be recommended for emergency neutron dosimetry and neutron spectrometry. (auth)

14174 HOMOGENEOUS SEMICONDUCTOR DETECTORS. Chapter III. Lyapidevskii, V. K.; Vasilevich, A. F.; Volkov, N. G. pp 50-64 of Poluprovodnikovye detektory v dozimetrii ioniziruyushchikh izluchenii. Lyapidevskii, V. K. (ed.). Moscow; Atomizdat (1973). (In Russian).

This book chapter considers features of homogeneous semiconductor detectors used in the dosimetry of x ray and gamma radiation. Physical properties are given for semiconducting materials (silicon, germanium, diamond, gallium arsenide, gallium phosphide, cadmium sulfide and cadmium telluride) at 300°K. Consideration is given to contact phenomena in semiconducting detectors, and to detector operation in the pulse and current modes. (tr-SJR)

14175 FRICKE DOSIMETER WITH ENHANCED SENSITIVITY. Todorov, V. (Nauchno-Izsledovatelski Onkologichen Inst., Sofia (Bulgaria)). Rentgenol. Radiol.; 12: No. 1, 41-45(1973). (In Bulgarian).

The admixture of triethanolamine led to a fourfold rise of Fricke-dosimeter sensitivity (sensitization). Sensitized dosimeter provides an adequate reproducibility of results in measuring high energy ionizing radiation doses (from 1 to 8 krd), widely used in medical plactice. Dosimeter qualities were not deteriorated by sensitization. (auth)

14176 UTILIZATION OF A SILICON DETECTOR FOR INTERNAL DOSE MEASUREMENTS IN TELE-COBALT-THERAPEUTICS OF UTERUS NECK CANCER. Terlecki, J.; Kobierska, A.; Kornicka-Mlodkowska, H.; Ostrowska, T. (Akademia Medyczna, Gdansk (Poland)). Postepy Fiz. Med.; 7: 209-213(1973). (In Polish).

There is presented a silicon detector of the type GD-1 for dose penetration measurement in tele-cobalt-therapeutics. The examination was carried out with the patients being under cure for the uterus neck cancer, and the measured doses were compared to those taken in a theoretical way. The differences range about ±2 to 13%, where for obese persons they were a little bit greater. The possibility of direct measurements may allow in selected cases a more precise planning of the cure. (auth)

14177 SOFT X-RAY DOSIMETER. Sundararao, I. S.; Kannan, A.; Naik, S. B.; Sankaran, M. P. (Bhabha Atomic Research Centre, Bombay (India)). Indian J. Radiol.; 26: No. 1, 18-21(1972).

The design which simplifies the operation and maintenance and minimizes the known uncertainties of the existing soft x-ray dosimeters is illustrated. It is calibrated against a low-energy free chamber making the overall accuracy better. The ionization chamber is made energy independent. Theoretically, it could be operated up to exposure rates of about 4000 R/sec with a maximum ion collection efficiency of more than 99.5%. Though calibrated for the normal incidence of the x-ray beam on the front wall of the chamber, the angular orientation of the latter within 5° to the normal was not found to introduce significant errors in measurements. (auth)

14178 MEASUREMENT OF ENVIRONMENTAL RADIOACTIVITY USING EXOELECTRON DOSIMETERS. Kriks, H. J.; Rasp, W.; Siegel, V. (Physikalisch-Technische Bundesanstalt, Braunschweig, Ger.). pp 185-196 of Environmental Surveillance Around Nuclear Installations. Vol. II. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol.2); CONF-731117-(P2).

There are only a few methods in existence of monitoring contaminating radioactivity in the environs of reactors and other nuclear facilities. Because of the large numbers of monitors required, they should be inexpensive, re-usable, and quick and simple to read. Further, they should have a high sensitivity, a sufficient accuracy, show low fading, and be independent of ambient conditions. These requirements are fulfilled to a large extent by exoelectron dosimeters based on beryllium oxide. Preliminary measurements with such dosimeters have been carried out at 50 positions around the FMRB reactor of the Physikalisch-Technische Bundesanstalt. At each site a capsule was placed that contained two ceramic BeO dosimeters and two BeO powder dosimeters. Control measurements made using a very sensitive scintillation dose-rate meter showed exposure rates of between 8 and 15 μR/h at points far away from the reactor, these levels being those of the natural background radiation. Slightly higher values were observed nearer the reactor building and the exhaust stack. The results showed that the monthly dose of environmental radiation can be measured by exoelectron dosimeters with sufficient accuracy. Because of the higher sensitivity of the ceramic dosimeters (about a factor of 100 as compared with powder dosimeters) they are well suited for making measurements over shorter periods, e.g., monthly. The BeO powder dosimeters, the results of which slow less scatter than those of the ceramic dosimeters, are better suited for measurement periods extending beyond 6 months. (auth)

Nuclear Spectroscopic Instrumentation

Refer also to abstract 15340.

14179 (AWRE-O-44/74) GLASSY: A HIGH-THROUGHPUT, LOW-COST COMPUTER PROGRAM FOR THE ANALYSIS OF GAMMA SPECTRA OBTAINED WITH A Ge(Li) DETECTOR. Brooke, N. M.; Wood, G. A. (UKAEA Weapons Group, Aldermaston. Atomic Weapons Research Establishment). Nov 1974. 61p. Dep. NTIS (US Sales Only) $6.25. UK £1.00.

A FORTRAN IV program (GLASSY) was developed from GASPAN for the analysis of γ-spectra produced by a Ge(Li) detector. It has been extensively adapted, especially for application to the rapid and cheap analysis of large numbers of mixed spectra with low failure rates. The general principles and structure of the program are described, together with comments on its performance up to the present time. Details of the program's structure and operation are given in the appendices. (auth)

14180 (CEA-N-1723) USE OF FOURIER TRANSFORM IN SMOOTHING DATA, SUBTRACTING BACKGROUND AND UNFOLDING SPECTRA IN NUCLEAR PHYSICS. Valero, S. (CEA

Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire). Jun 1974. 66p. (In French). Dep. NTIS (US Sales Only) $6.50.

Analytical study is made of the Fourier transform of discrete spectra like the ones encountered in nuclear physics experiments; their mathematical properties give the basis for practical procedures for background subtraction, smoothing data, or unfolding spectra. Small-size codes can be expected from this method. (auth)

14181 (CNEN-LVF-73-57) REALIZATION OF SETTING UP A NEUTRON SPECTROMETER IN THE RANGE 0.2 TO 1.2 MeV. Merolli, S.; Roccella, M. (Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati). Sep 1973. 7p. INIS.

A neutron spectrometer using γ-n discrimination on the pulse shape in a trans-stilbene crystal is described. Discrimination efficiency was proved to be higher than 1% up to proton energies of about 150 to 200 keV. The efficiency of proton detection was practically equal to 1 for protons of energy $\geq$ 0.6 MeV. In order to extend the energy range of utilization of the spectrometer to lower values, proton detection efficiency has been measured up to 150 keV discriminating γ from neutrons in an Am-Be source by means of the time-of-flight method. An efficiency of about 30% was measured at such energies. The spectrometer was developed especially in view of its exploitation at high γ dose rates and arrangements have been adopted for this purpose that allow improved discrimination power of a factor higher than 10. (INIS)

14182 (COO-535-710, pp 67-72) SHORT-LIVED RADIOACTIVITY INDUCED IN Ge(Li) GAMMA-RAY DETECTORS BY NEUTRONS. Bunting, R. L.; Kraushaar, J. J. 1 Nov 1974.

In technical progress report, November 1, 1973-November 1, 1974.

14183 (COO-535-710, pp 133-135) EFFICIENCY OF THE 34 cc Ge(Li) DETECTOR. Fritts, M. J.; Ingalls, P. D. 1 Nov 1974.

In technical progress report, November 1, 1973-November 1, 1974.

14184 (IAE-2288) OPERATIVE DATA HANDLING OF NEUTRON SPECTRA OF (x,n) REACTIONS OBTAINED BY THE TIME-OF-FLIGHT METHOD. Pasynkov, I. G.; Faiziev, A. R.; Chulkov, L. V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1973. 20p. (In Russian). INIS.

A description is given of the VREMYA program designed for processing neutron spectra in experiments using the time-of-flight method. The program is used in the framework of the operative system of the M-220 and is triggered by pulses from the cyclotron measurement center. Data input in the M-220 originates from communication lines from MOZU AI-4096. The spectral parameters of the experiment are introduced by an input-output installation (VVU) into the first 512 channels of the AI-4096. The neutron spectra are recorded successively by 512-channel groups and are marked off with a light pencil at the control desk. The calculation results are distributed in text format both to the ATsPU-128 of the M-220 computer and to the VVU. Tables of the values used, a block diagram, and the program text are given. (tr-auth)

14185 (IAE-2303) DETECTOR OF TOTAL ABSORPTION FOR NEUTRON CAPTURE GAMMA RAYS. Gerasimov, V. F.; Zenkevich, V. S.; Perequdov, V. M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1973. 19p. (In Russian). INIS.

The possibility of using barium fluoride as a scintillation detector of total absorption for neutron capture γ rays was examined. An evaluation was made of its dimensions, spectral line effects, and background. (tr-auth)

14186 (IFA-FN-46-1974) RESOLUTION OF SLOW NEUTRON SPECTROMETERS. IV. The Triple-Axis Spectrometer Resolution Function, Spatial Effects Included. Popovici, M. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 27p. Dep. NTIS (US Sales Only) $4.50.

The procedure of computing the resolution function of triple-axis spectrometers is reformulated so as to make allowance for the spatial configuration of the experimental set-up and for the curvature of the monochromator and analyser crystals. Simple formulas are given for computing the resolution function of conventional instruments as well as of spectrometers with focusing crystals. (auth)

14187 (JINR-10-7074) FOUR-ENTRY RECORDING SYSTEM ON THE BASE OF INTERNAL MAGNETIC MEMORY OF MINSK-2 FOR SPECTROMETRIC MEASUREMENTS. Zaidler, Z.; Kondrat, E. T.; Stancheva, N. S.; Stanchev, S. M.; Tsupko-Sitnikov, V. M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1973. 18p. (In Russian). INIS.

A description is given of a four-entry system based on the Minsk-2 memory, by which it is possible to carry out measurements with four independent spectrometric inlets having a total number of 8192 channels. By means of inlets through ATsI, there is a mode of writing information through a special accumulator register. A fixed selection of interrogation frequency is also achieved by modifying the memory beat. This feature assures the required flexibility in modes of operation, substantially simplifies control, and increases the operating reliability. The system has an exit to an accumulator with a magnetic drum, a graph plotter and a "Minsk-2" computer. Display on a large-diameter tube assures observation of any part of the memory. (tr-SJR)

14188 (JINR-13-7125) LINEAR AMPLIFIER FOR SPECTROMETRIC MEASUREMENTS. Andert, K.; Gabriel, F.; Kalinin, A. I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1973. 16p. (In Russian). INIS.

A spectroscopic amplifier with effective filters for obtaining forms of the output pulses close to Gaussian is described. The amplification coefficient can be regulated from 2.5 to 3000. The steady shaping can be switched from 0.25 to 10 μ sec. The amplifier is connected with a direct current having linear regeneration of the zero level and can operate at high loads up to 10^5 pulses/sec. The maximum amplitude of the output pulses is $\pm$ 12 V. The amplifier withstands a large amplitude overload. (tr-auth)

14189 (JINR-13-7466) SPECTROMETER WITH Si SEMICONDUCTOR DETECTORS FOR STUDYING CORRELATION BETWEEN TWO CHARGED PARTICLES. Krumshtein, Z. V.; Semyarchuk, T.; Shavlovskii, M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1973. 15p. (In Russian). INIS.

A spectrometer with semiconductor silicon detectors is described for studying correlations between two charged particles. The results of measuring the time resolution are presented, and the ability to separate secondary particles from the equipment was studied. Experiments were carried out on the proton beam of the OIYaI synchrocyclotron. The spectrometer was developed in the Laboratory of Nuclear Problems. (19 refs) (tr-SJR)

14190 (USIP-73-12) 2Ge(Li)-5NaI(Tl) DETECTOR SYSTEM FOR GAMMA-GAMMA DIRECTIONAL CORRELATION STUDIES. Eriksson, L.; Gidefeldt, L. (Uppsala Univ. (Sweden). Fysiska Institutionen). Sep 1973. 8p. INIS.

A multidetector system is described. Twelve Ge(Li) coincidence spectra as well as the associated twelve random coincidence spectra can simultaneously be recorded. The over-all performance has been checked. (auth)

14191 BIASED MAGNETIC QUADRUPOLE SPECTROMETER FOR HIGH-RESOLUTION CHARGED-PARTICLE MASS IDENTIFICATION. Hoffmann, G. W.; McIntyre, J.; Mahlab, M.; Coker, W. R. (Texas Univ., Austin (USA). Center for Nuclear Studies). Nucl. Instrum. Methods; 120: No. 3, 489-495(15 Sep 1974).

A charged-particle energy-mass identification system is described which uses an offset, slightly rotated, magnetic quadrupole doublet in conjunction with a single lithium-drifted silicon detector. Perfect particle identification is achieved while maintaining the high resolution of the single charged-particle detector. The versatility, low cost, and ease of use of this device make it a very attractive tool for precision nuclear-reaction studies. (auth)

14192 RELATIVE EFFICIENCY CALIBRATION OF A Si(Li) ELECTRON SPECTROMETER. Jardine, L. J.; Lederer, C. M. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Nucl. Instrum. Methods; 120: No. 3, 515-520(15 Sep 1974).

A method for determination of the relative efficiency of Si(Li) electron spectrometers with the sources ^{180m}Hf, ^{207}Bi, and ^{210}At is described. New measurements of some relative γ-ray (photon) intensities in ^{180m}Hf and ^{207}Bi are given. Electron line intensities for all three sources, calculated from the decay schemes, γ-ray intensities, and theoretical internal conversion coefficients, are tabulated. (auth)

14193 LIVE TIME AND PILE-UP CORRECTION FOR MULTICHANNEL ANALYZER SPECTRA. Cohen, E. J. (California Inst. of Tech., Pasadena (USA)). Nucl. Instrum. Methods; 121: No. 1, 25-32(1 Oct 1974).

For a non-varying count rate it is shown that the live time and pile-up correction can be determined without the purchase of additional equipment. The analyzer live time (T_L) can be measured with the analyzer live time clock after a small modification is made. The pile-up correction is given by $1-\tau_{pu}N/T_L$, where τ_{pu} is the pile-up inspection time and N is the total counts received by the analyzer while it is live. No other term is needed for the pile-up correction. (auth)

14194 DESCRIPTION AND PERFORMANCE OF A DEMOUNTABLE ^{6}Li SANDWICH FAST NEUTRON SPECTROMETER. Koutzoukos, G.; Besant, C. B. (Imperial Coll. of Science and Technology, London (UK). Dept. of Mechanical Engineering). Nucl. Instrum. Methods; 121: No. 1, 55-63(1 Oct 1974).

A demountable fast neutron spectrometer for in-core measurements, employing the ^{6}Li spectrometry technique, has been developed. Surface barrier diodes destroyed by fast neutron irradiation can be replaced from the sandwich inside the spectrometer, permitting re-use of the undestroyed diode and the can. Its performance was tested over the range 10 keV to 7 MeV by measuring the neutron spectrum in the standard spectrum facility NISUS. Results are presented from these measurements together with a discussion on the energy calibration of such spectrometers. (auth)

14195 AN ON-LINE STABILITY MONITOR FOR MOESSBAUER SPECTROMETERS. Gangas, N. H. J.; Prelorendjo, L. A. A. (Ioannina Univ. (Greece). Dept. of Physics). Nucl. Instrum. Methods; 121: No. 1, 105-109(1 Oct 1974).

The principle of operation and the practical features of a simple electronic circuit which permits the on-line monitoring of the performance of Moessbauer spectrometers during the time of measurements are described. The circuit produces in the Moessbauer spectrum two dummy "resonance" lines, whose positions and widths reveal to the experimenter the overall performance of his spectrometer. For a constant-acceleration spectrometer the sensitivity of the circuit is such that a 1% variation of the calibration of the spectrometer produces a visually detectable change in the position of a dummy line. (auth)

14196 SUPERCONDUCTING MAGNETIC SYSTEM FOR USE IN NUCLEAR SPECTROSCOPY. Tarkanyi, F.; Novak, D.; Fule, K. (ATOMKI, Debrecen, Hungary). ATOMKI (At. Kut. Intez.) Kozlem.; 16: No. 4, 325-337(1974). (In Hungarian).

A superconducting magnetic system was built to be used as an electron transporter in an in-beam conversion electron spectrometer. The magnetic characteristics of the system are described. The field created by the two Nb-Ti coils in a bore of ϕ 4 cm and in a length of 2 × 9 cm, has an average field strength of 32 kOe, while its distribution along the axis guarantees, that its magnetic mirror effect for the transported electrons will be small. (auth)

14197 NOTE TO "THE COMPUTER PROGRAM ALGAMMA FOR THE ANALYSIS OF γ-RAY SPECTRA . . .". Szekely, G. (ATOMKI, Debrecen, Hungary). ATOMKI (At. Kut. Intez.) Kozlem.; 16: No. 4, 355-360(1974).

The code ALGAMMA has been rewritten and developed in FORTRAN-IV. The features of this code named FORGAMMA are described in comparison with ALGAMMA. (auth)

High Energy Physics Instrumentation

14198 (IFVE-SVM-73-92) RECONSTRUCTION OF THE PARTICLE PARAMETERS IN A TRACK DETECTOR WITH MODERATING MATERIAL PLATES AND A MAGNETIC FIELD. Zhigunov, V. P.; Perelygin, V. F.; Spiridonov, A. A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 21p. (In Russian). INIS.

Generalization of a functional is given for determining particle trajectory parameters in a track detector with a moderator and a magnetic field in the detector. The functional is constructed with measuring errors, energy loss straggling and multiple coulomb scattering being taken into account. (tr-SJR)

14199 (JINR-1-7305) MUON DETECTOR IN EXPERIMENTS WITH NEUTRAL KAONS. Birulev, V. K.; Vestergombi, D.; Vovenko, A. S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1973. 12p. (In Russian). INIS.

A description is given, and results are presented on an analysis of the operation of a muon detector designated for the separation of K^+ (μ3) decays in experiments with neutral kaons. It is shown that under the experimental conditions the probability of an incorrect identification of muons with momenta of 5 to 25 GeV/c is equal to 1%. The detector was created in the nuclear physics laboratory. (tr-SJR)

14200 (RL-74-049) PROGRAMMING THE FORMULA EVALUATOR. Maclean, C.; McPherson, G.; Wilde, P. (Science Research Council, Chilton (UK). Rutherford Lab.). Mar 1974. 27p. Dep. NTIS (US Sales Only) $4.50.

The Formula Evaluator is a restricted purpose high speed digital computing unit that can be used as an add-on accessory to any standard small computer. It is described as a restricted purpose computer because, though broadly speaking a general purpose computer, it is designed to be highly efficient for certain operations, in particular for evaluating formulas. Further, the design is such that one can add hardware appropriate to a particular application. The computer is controlled by a program held in its own memory and is supplied with data from, and returns results to, a host computer. The basic computer and its machine code are briefly described. Included is some special hardware oriented towards solving the problem of track recognition in digitized spark or proportional chambers. A symbolic assembler which can simplify the programming of the computer is described. The assembler will normally run on the host computer and versions have been written for the Modular One and the PDP 8 computers. Finally, these two aspects are combined through the discussion of the track recognition program. (auth)

14201 (RL-74-061) SUMX ON THE RUTHERFORD LABORATORY CENTRAL COMPUTER. Hemmings, P. J.; Donaldson, G. R. (Science Research Council, Chilton (UK). Rutherford Lab.). Apr 1974. 14p. Dep. NTIS (US Sales Only) $4.00.

A recent version of SUMX (version 6.06) is available on the 195. This broadly corresponds to the SUMX USER'S MANUAL that was reissued during 1973. (CERN PROGRAM LIBRARY, LONG WRITE-UP Y200). These notes should be used in conjunction with the user's manual. SUMX may be used either as an executable program or the user may include routines from SUMX with routines of his own. Three catalogued procedures are provided. The procedure RLSUMX1 is for direct execution of SUMX. The procedure RLSUMX3 is essentially FORTH with modifications to obtain the correct linkage with SUMX. RLSUMX4 is an extension of RLSUMX3 to allow common block and other definitions to be obtained from the PATCHY preprocessor. In each case the last digit is the number of steps in the procedure. RLSUMX is an alternative name for RLSUMX4. The use of these procedures is illustrated by examples. The procedures RLSUMX3 and RLSUMX4 (alias RLSUMX) that are extensions of FORTH also have an extension to the automatic call library of a subset of the CERN Program Library. Versions of all the routines in the TC general section are available plus certain other routines in the CERN Program Library. SUMX was written primarily for processing data from bubble chamber film. (auth)

14202 USE OF CORRELATION COUNTING IN VISUAL SCANNING. Auslaender, J. S.; Rehak, P. (Karlsruhe Univ. (TH) (F.R. Germany). Inst. fuer Experimentelle Kernphysik). Nucl. Instrum. Methods; 120: No. 3, 465-467(15 Sep 1974).

The true number of events in track chambers or similar frames can be estimated by double scan without classification of the individual events according to their appearance in both scanning runs or only in one of them. The estimate thus obtained has a much larger variance than that obtained by the conventional method of double scan. Under certain circumstances this disadvantage is compensated by a considerable economy of work and time. (auth)

14203 CALIBRATION OF A LEAD-GLASS GAMMA DETECTOR USING ELECTRONS UP TO 5 GeV AND TAGGED PHOTONS OF 39-270 MeV. Dibon, H.; Fluegge, G.; Friend, B.; Nefkens, B. M. K.; Neuhofer, G.; Niebergall, F.; Regler, M.; Schmidt-Parzefall, W.; Schubert, K. R.; Schumacher, P. E. (European Organization for Nuclear Research, Geneva (Switzerland)). Nucl. Instrum. Methods; 120: No. 3, 437-443(15 Sep 1974).

The performance and calibration of telescopes for the measurements of γ-ray spectra in the GeV range are described. The detection efficiency for γ-rays converted in a radiator has been measured and found in agreement with calculations. The linearity and energy resolution of the total absorption counter have been investigated between 0.1 and 5 GeV. (auth)

14204 IMAGE INTENSIFIER CAMERA FOR STREAMER-CHAMBER PHOTOGRAPHY. Gentsch, H.; Gygi, E.; Hanney, M.; Schneider, F. (European Organization for Nuclear Research, Geneva (Switzerland)). Nucl. Instrum. Methods; 120: No. 3, 431-436(15 Sep 1974).

A three-stage image intensifier camera is described which makes it possible to record on film tracks of an isotropic streamer chamber; the precision of reconstruction of a distorted image is given. (auth)

14205 PULSE-HEIGHT ENCODERS FOR THE ANALYSIS OF A LARGE COUNTER SYSTEM. Bushnin, Yu. B.; Johnson, R. P.;

Krasnokutsky, R. N.; Mikhailov, Yu. V.; Morozov, V. N.; Prokoshkin, Yu. D.; Shuvalov, R. S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst Fiziki Vysokikh Ehnergij). Nucl. Instrum. Methods; 120: No. 3, 381-384 (15 Sep 1974).

The 4096-channel pulse-height encoders used for the analysis of a 648-counter system are described. Eight encoders are placed on less than one-half of a single-width CAMAC unit. The circuit has a linear response for input pulses between 1 mV and 1 V and is quite stable. The encoders were developed for a large hodoscope spectrometer which is used to detect high-energy photons in the experiments at the 70-GeV/IHEP accelerator. (auth)

14206 PULSE-HEIGHT ANALYSIS OF A LARGE COUNTER SYSTEM. Inyakin, A. V.; Johnson, R. P.; Krasnokutsky, R. N.; Lebedev, A. A.; Mikhailov, Yu. V.; Prokoshkin, Yu. D.; Shuvalov, R. S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). Nucl. Instrum. Methods; 120: No. 3, 385-387(15 Sep 1974).

The logical units for the control of a pulse-height analysis system of a 648 counter hodoscope spectrometer are described. The CAMAC system is used to accumulate the experimental data, measure the counter high voltages, test the linearity and stability of the pulse-height encoders, and test the scalars under simulated experimental conditions. (auth)

14207 AN ECONOMICAL METHOD FOR MEASURING HIGH VOLTAGES IN A LARGE COUNTER SYSTEM. Johnson, R. P.; Krasnokutsky, R. N.; Mikhailov, Yu. V.; Morozov, V. N.; Prokoshkin, Yu. D.; Shuvalov, R. S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). Nucl. Instrum. Methods; 120: No. 3, 389-390 (15 Sep 1974).

In experiments with large numbers of photomultipliers, especially where pulse-height information is used, control of high voltages is one of the major problems. However, it is often not necessary to know the absolute values of the applied high voltages. All that is needed is a method to measure relative high voltages, so that the counters can be tuned to the requirements of the experiment. Once the correct voltage has been determined, the relative high voltage can be used to test and correct for any drifts which might occur. A computer can be used to make numerical corrections and display the measured results. In this paper a high-voltage measurement system for a large hodoscope spectrometer with 648 scintillation counters is described. The measurements are made to 0.1% with a computer-controlled CAMAC system. (auth)

14208 A HODOSCOPE SPECTROMETER FOR HIGH-ENERGY PHOTONS. Bushnin, Yu. B.; Donskov, S. V.; Inyakin, A. V.; Johnson, R. P.; Kachanov, V. A.; Klimenko, S. V.; Krasnokutsky, R. N.; Lebedev, A. A.; Lednev, A. A.; Mikhailov, Yu. V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). Nucl. Instrum. Methods; 120: No. 3, 391-400(15 Sep 1974).

A scintillation-counter hodoscope spectrometer developed at IHEP to detect high-energy photons is described. The detector can simultaneously measure the position (to 2 mm) and energy (5 to 10%) of several photons. The device is made with 648 scintillation counters, arranged to form hodoscopes and sandwiched between layers of iron converter. The useful area of the spectrometer is about 1 m^2. Pulse-height analysis is performed on each of the 648 counters with 12-bit ADCs. Photon position is determined using the center of gravity of the shower amplitudes in the hodoscope counters. To eliminate ambiguities in multi-photon events, the showers are measured in three 120° projections. The total thickness of the spectrometer is 20 r.l. of steel in the beam direction. This provides total absorption of photons and electrons with an energy up to 1000 GeV. The characteristics of the spectrometer as used in experiments at the 70 GeV IHEP accelerator are described. (auth)

14209 NOTE ON CLEAR PLASTICS WITH WAVELENGTH SHIFTERS SUITABLE FOR CHERENKOV DETECTORS. Atallah, K.; Schmidt, W. K. H. (Max-Planck-Institut fuer Physik und Astrophysik, Garching; Muenchen (F.R. Germany). Inst. fuer Extraterrestrische Physik). Nucl. Instrum. Methods; 120: No. 3, 539-540(15 Sep 1974).

The Cherenkov light yield of several plastic materials with wavelength shifters is improved over plain Plexiglas, while the scintillation of these materials remains low. (auth)

14210 STIMULATED EMISSION IN NEON–HELIUM STREAMER CHAMBERS. Stetz, A. (Alberta Univ., Edmonton (Canada). Nuclear Research Centre). Nucl. Instrum. Methods; 121: No. 1, 5-11(1 Oct 1974).

The possibility of using stimulated emission in the discharge of a streamer chamber to improve the quality of the image that is photographed has been investigated. The incremental gain from stimulated emission obtainable in a practical streamer chamber has been estimated from some related experiments with pulsed lasers. A model of the dynamics of laser-beam formation in a streamer chamber has been constructed and the light available for photography estimated. The calculations show that, with plausible values for the population inversion in the streamer-chamber discharge, one can hope to obtain considerable intensification of the streamer image. (auth)

Radiometric Instruments

Refer also to abstracts 14007, 14707, and 14709.

14211 (SAND-74-8508) FILM THICKNESS MEASUREMENTS BY BETA RAY BACKSCATTERING TECHNIQUES. Fischer, H. Aug 1974. Translation by Patricia Newman of Schichtdickenmessungen nach dem Betastrahlen-Ruckstreuverfahren. (CONF-701158-1). 16p. Dep. NTIS $4.00.

From EIPC conference on quality control of PC boards; Munich, F.R. Germany (9 Nov 1970).

The technique and apparatus for measuring film thickness by the beta-ray backscattering principle are described. (WHK)

14212 RADIOMETRIC PROCESS GAGING USING RADIONUCLIDES. Review. Netz, V. (VEB RFT Messelektronik Otto Schoen, Dresden (German Democratic Republic)). Impuls.; 13: No. 3, 116-122(1973). (In German).

New and improved measuring instruments of VEB RFT Messelektronik "Otto Schön" Dresden demonstrated at the 1973 Leipzig spring fair are described and typical applications are given. (INIS)

14213 RECOMMENDED PRACTICE FOR STANDARD CALIBRATION AND FORMAT FOR NUCLEAR LOGS. ARI RB 33. Washington, DC; American Petroleum Institute (1974). 13p. (ICONS-01845).

This recommended practice presents specifications for the American Petroleum Institute (API) Nuclear Logging Calibration Facility for establishing standard API Gamma-Ray and API Neutron Units for nuclear logs, and for calibrating logging tools in these units. It also presents a standard nuclear log format and heading. (TFD)

14214 APPLICATION OF THE MUON METHOD TO THE DETERMINATION OF THE DENSITY OF ROCKS IN THE CASE OF A BACKGROUND OF HIGH RADIOACTIVITY. Bondarenko, V. M.; Brovkin, V. I.; Tarkhov, A. G.; Chertkov, V. Ya.; Polyakov, V. N.; Prozorov, L. B. Sov. At. Energy (Engl. Transl.); 36: No. 6, 656-658(Jun 1974).

Translated from At. Energ. (USSR); 36: No. 6, 518-520(Jun 1974).

The determination of the density of rocks in their natural beds, as well as under artificially created bedding conditions in hydrotechnical working or other building sites, is of great importance for the solution of many problems of applied geology. The borehole version of the muon method is described. The method is successfully employed in determinations of both the average density and the layerwise density of rocks. IIKL-2 equipment comprising two main components, namely a borehole probe and a recording panel on the surface, is used to record the intensity of the muon component of the cosmic radiation in boreholes. The block scheme of the borehole equipment comprises three basic units: the muon detector unit; the detector autocalibration unit; and a voltage stabilizing unit. The detector unit consists of three muon detectors, amplifiers, discriminators, a coincidence circuit, and output pulse-shaping circuits. Cherenkov counters made of TF-1 flint glass are used as the radiation detectors. The use of the heavy flint glass and the use of discriminators, as well as the possible adjustment of the gain of the photomultipliers, fully eliminate the influence of the radioactive background from the rocks upon the results of the intensity measurements on cosmic muons. (WHK)

14215 A NEW METHOD OF CALIBRATING A NEUTRON MOISTURE METER AND A CORRECTION FOR THE EFFECT OF SOIL BULK DENSITY. Karsten, J. H. M.; Haasbroek, F. J. (Fruit and Food Technology Research Inst., Stellenbosch (South Africa)). Agrochemophysica; 5: 35-40(1973).

Summary in Afrikaans and French.

A combined neutron moisture and gamma density meter was employed to develop a simplified technique by which both the moisture and density calibration curves as well as a density correction factor can be obtained simultaneously. By means of

an iteration process, routine moisture and density meter readings are transformed respectively to percentage moisture by volume, corrected for the effect of bulk density, and the dry bulk density of the soil. (INIS)

14216 NON-DESTRUCTIVE EXACT MEASUREMENTS OF THICKNESS OF COATINGS BY BETA BACKSCATTERING METHOD. Martinus, B. (Swaay (van) Electrotechniek, The Hague). Belg.-Ned. Tijdschr. Oppervlakte Tech. Metal.; 18: No. 9, 275-278(Sep 1974). (In Dutch).

A practical survey is given of the principles, the apparatus, the applicability and the accuracy of the beta backscattering method for controlling the thickness of protective metal coating layers. The radioactive sources are promethium-47, thallium-104 and strontium-90. This nondestructive test method is fast, reliable and gives reproducible results. (NL)

Radiation Effects on Instrument Components, Instruments, or Electronic Systems

14217 (ONERA-NT-200) INFLUENCE OF SPACE RADIATIONS ON THE CACTUS ULTRASENSITIVE ACCELEROMETER. Tiffon, J. (Office National d'Etudes et de Recherches Aerospatiales (ONERA), 92 - Chatillon (France)). 1972. 56p. (In French). Dep. NTIS (US Sales Only) $6.00.

During the orbital flight of the D5-B satellite, made by C.N.E.S. (the French Space Agency), devoted to the qualification of the CACTUS ultrasensitive accelerometer made by O.N.E.R.A., the electric charge gathered by the proof mass of this accelerometer under the influence of high energy radiations may perturb the operation of this instrument. A bibliographic study shows that this charge effect is mainly due to the protons and electrons of the Van Allen belts through which the D5-B satellite will fly. The various characteristics of the proton and electron interaction process with the matter lead to the separate study of the influence of these two kinds of particles on the level of the mass electric charge. Periodic discharges of this mass by contact are being considered. These results permit to determine the frequency of these discharges. (FR)

14218 (WANL-TME-1251) FINAL TEST SPECIFICATION FOR STRAIN GAGES TO BE IRRADIATED AT THE PLUM BROOK REACTOR (23/W408). Kalning, L.; Rothleder, B. M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1965. 13p. Dep. NTIS $4.00.

Specifications for an experiment designed to evaluate the performance of foil gages bonded with inorganic cement in a nuclear radiation environment are described. Also, Microdot weldable gages will be irradiated in order to define further the nature and cause of the zero shift observed during the July, 1964, PBRF test (23/W406). There will be four pairs of Budd "C" series gages bonded with "H" ceramic cement and six active-dummy Microdot weldable gages. Of the six weldable gages, four will be welded to constant strain beams for dynamic actuation while the other two will be welded to an unstrained member of the fixture. The test items will be operated at the maximum radiation levels for 28 hours. This is intended to provide performance data with respect to the integrated fast neutron flux that would be encountered in a one-hour, full power NRX test. The data obtained in this test will be used to predict the performance of the strain gages when subjected to NRX environmental conditions. (WHK)

14219 (WANL-TME-1450) AGC PRESSURE TRANSDUCER EXPERIMENT NO. 23/R510 IRRADIATED AT THE PLUM BROOK REACTOR FACILITY PBRF CYCLE 47. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1966. 37p. Dep. NTIS $5.00.

The experimental data from an irradiation of pressure transducers in the Plum Brook reactor are presented. The purpose of this test was to evaluate the performance of Consolidated Controls Corporation linear variable differential transformer transducers in a nuclear radiation environment and to study the effects of nuclear radiation heating on these transducers. (WHK)

14220 CHANGES IN THE TEMPERATURE DEPENDENCE OF THE CONDUCTIVITY OF NONLINEAR SEMICONDUCTOR RESISTORS OF BLACK SILICON CARBON DUE TO REACTOR NEUTRON RADIATION. Ribarov, S. R. (Bylgarska Akademiya na Naukite, Sofia. Fizicheski Inst.). Compt. Rend. Acad. Bulg. Sci.; 26: No. 5, 627-630(1973). (In Russian).

A study was conducted on commercial high-voltage varisters having metallic electrodes. Heating of the samples placed in a massive lead cylinder was carried out in a thermostatted oil bath. The studies were carried out in the temperature range of 25 to 90°C. The temperature of the samples under study was measured with an error less than 0.5°C. Before irradiation the varister current depends on the temperature almost linearly. After irradiation, with an increase in temperature the varister current increases nonlinearly. This behavior is apparently caused by partial annealing of radiation defects at a temperature on the order of 100°C. On lowering the temperature the dependence is closer to linear, since part of the radiation defects have already undergone annealing. The observed difference in the course of the temperature dependence of the varister current on increasing and lowering the temperature was also noted in measurements carried out later. As a result of multiple heating of the irradiated varister to a temperature of 90 to 100°C, most probably annealing of radiation defects occurs, in view of which the curves of the temperature dependence of the varister current on raising and lowering the temperature coincide. In this case the temperature dependence of the current of the irradiated sample is greater than the temperature dependence of the unirradiated sample. As a result of irradiation the temperature coefficient of varister current increases. Interpretation of changes in the temperature dependence of the conductivity of varisters as a result of neutron irradiation is difficult. It is proposed that neutron radiation changes the properties not only in the body of the single-crystal grains of SiC, of which the varisters are made, but also the properties of contact surface regions, whose mechanism has not been elucidated. (tr-SJR)

Miscellaneous Instruments

Refer also to abstracts 13942, 13943, 14706, 15641, 15653, 15658–15660, 15665, 15687, 15690, 15695, 15698, 15770, and 15788.

14221 (BNWL-SA-5064) CHRONIC BLOOD IRRADIATION: A NEW APPROACH. Hungate, F. P.; Riemath, W. F.; Bunnell, L. R.; Gillis, M. F. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1973. Contract AT(45-1)-1830. 16p. (CONF-740930-11). Dep. NTIS $4.00.

From 14th Hanford biology symposium on radiation and the lymphatic system; Richland, Washington, USA (30 Sep 1974).

A new fully portable, inexpensive irradiator is described. It uses the beta emitter ^{170}Tm contained on both a macro and micro scale in a vitreous carbon body. The irradiator effectively suppresses lymphocyte levels and extends allograft survival times. Construction of initial units involves sequential formation of three layers of polymerized furfuryl alcohol. A 50-mm-long pyrolytic graphite tube was used for the blood interface. A 6-mm-thick lead shield was machined to fit over each end of the irradiator unit, reducing the surface dose to 25 mR/hr. The irradiator was tested on a pygmy goat and an 80% reduction of circulating lymphocytes was the only clear response. (HLW)

14222 (CEA-N-1625) MICROCALORIMETER–BALANCE. Barberi, P.; Paillet, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Genie Isotopique). 23 Feb 1971. 14p. (In French). Dep. NTIS (US Sales Only) $4.00.

A miniature microcalorimeter was coupled to a McBain thermobalance with a view to determine the heats of formation of uranium VI–alkaline fluoride complexes. The apparatus and its calibration are described. (FR)

14223 (CONF-741085-1) EVALUATION OF STEAM-TO-SODIUM LEAK DETECTORS IN THE SODIUM COMPONENTS TEST INSTALLATION (SCTI). McKee, J. M.; Simmons, W. R. (Argonne National Lab., Ill. (USA)). [nd]. Contract W-31-109-eng-38. 18p. Dep. NTIS $4.00.

From symposium on steam generators for liquid metal fast breeder reactors; Bensberg, F. R. Germany (14 Oct 1974).

Two nickel diffusion-membrane type hydrogen detectors were installed in the secondary sodium system of the Sodium Components Test Installation and evaluated during the 12-month performance test of the Modular Steam Generator (MSG). Hydrogen in the expansion tank cover gas was monitored with a gas chromatograph. During this period, numerous steam and hydrogen injections were made, simulating steam leaks into the sodium of an LMFBR steam generator. The response of the detectors was evaluated for leak sizes ranging from 10^{-6} to 10^{-4} lb H_2O/sec, injection periods of 0.5 to 300 min, secondary sodium flow rates of 0.2×10^6 to 1.5×10^6 lb/h, and sodium temperatures of 400 to 950°F. The response of the leak detection system was influenced significantly by two regimes

of sodium temperature. Below 600°F, the cover gas hydrogen detector gave the largest response; this is attributed to the long dissolution time of hydrogen bubbles relative to the transit time of hydrogen to the expansion tank. Above 600°F, the hydrogen apparently dissolved rapidly and the detectors were much more effective in the sodium than in the cover gas. At least 75% of the hydrogen and 50% of the oxygen content of injected steam appeared as detectable activity if the reaction products were dispersed in the sodium stream and the sodium was above 600°F. Hydrogen injections into semi-stagnant sodium at the MSG tubesheets were detected with better sensitivity than steam injections into the main sodium stream. It appeared that high local concentrations of hydrogen were quickly carried to the nearest detector by upward currents created by the injected gas. The alarm system functioned as expected, 2.1 ppb/min being the smallest rate-of-rise in hydrogen concentration to give an automatic alarm. With more sensitive rate-of-rise alarm settings, leaks as small as 2×10^{-5} lb H_2O/sec could be detected in a system such as the Clinch River Breeder Reactor Plant. A preliminary assessment indicates that good protection can be afforded against leaks which start smaller than 2×10^{-4} lb H_2O/sec and gradually increase. Leaks larger than 3×10^{-4} lb H_2O/sec at the outset should be quickly detected, but could conceivably cause significant wastage damage in the time required to secure the system. (auth)

14224 (CONF-741226-1) ULTRASONIC AND JOHNSON NOISE FUEL CENTERLINE THERMOMETRY. Shepard, R. L.; Borkowski, C. J.; East, J. K.; Fox, R. J.; Horton, J. L.; Blalock, T. V. (Oak Ridge National Lab., Tenn. (USA); Tennessee Univ., Knoxville (USA). Dept. of Electrical Engineering). 1974. 39p. Dep. NTIS $5.00.

From international colloquium on high temperature in-pile thermometry; Petten, Netherlands (12 Dec 1974).

Rhenium ultrasonic (UST) and Johnson noise (JNT) thermometers were used to measure fuel centerline temperatures of 900 to 1500°C in capsules irradiated in the HFIR for periods of 1000 to 3000 hrs. Transmutation of rhenium by thermal neutron absorption caused large drifts in UST calibration but none in JNT calibration. Whole capsule, post irradiation calibration was used to measure drift in UST and to provide a calibration correction. Calculation of the temperature and the resistance of JNT rhenium sensor elements by noise power measurements have shown no temperature drift in over 1100 hrs at 1250°C. Performance of W – Re thermocouples UST and JNT in fuel irradiation centerline thermometry is compared. (auth)

14225 (EFI–36(73)) STABILIZED SUPPLY FOR THE SYSTEM OF NUCLEAR ELECTRONICS UNIFORM MODULES. Khyrshudyan, L. S.; Vukolov, V. P. (Erevanskij Fizicheskij Inst. (USSR)). 1973. 18p. (In Russian). INIS.

A structural diagram of stabilized power units for a uniform system of electronic units is described. The distinguishing characteristics are the use of two voltages (necessary in all standard nuclear electronics) of + and − 24 V as a base for the power of the comparison circuit and the organization of standard voltages of all other daughter power supplies. Three modifications of the power unit are given which satisfy the requirements imposed on electronic-physics devices. A brief analysis is made of existing power units and the advisability of using this type of power supply in the CAMAC system is indicated. (tr-auth)

14226 (EUR-4914) AUTEX INTERFACE MOD. 119, COUPLING A HEWLETT–PACKARD 2114-A COMPUTER TO A STEPPING MOTOR OPERATED POSITIONING DEVICE. Grosz, A.; Klage, D.; Van Montfoort, J. E. (Commission of the European Communities, Brussels (Belgium)). 1972. 44p. INIS.

The AUTEX system has been set-up for the automatic evaluation of nuclear fuel burn-up in reactor fuel elements by means of γ-ray absorption. The system consists of a two-dimensional positioning rig, carrying the fuel element under test, and a computer-based measurement and control system. The first function is executed under supervision of the Hewlett-Packard 5406B Executive Software. For the position control function, the AUTEX Software package, which will be published separately, has been implemented. This report describes the interface between the computer (Hewlett-Packard 2114A) and the electromechanical AUTEX system elements such as stepping motors, optical encoders and limit switches. Apart from computer-controlled operation, provisions have been made for manual positioning. (INIS)

14227 (JINR–10-7126) BUNCHING OF EVENTS IN THE "TIME-NUMBER-OF DETECTOR" MULTIDIMENSIONAL ANALYZERS. Shibaev, V. D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab of Neutron Physics). 1973. 12p. (In Russian). INIS.

A description is given of the grouping of events during multidimensional analysis of the type "time-detector number" with independent counting of events from each detector. The grouping unit which accumulates events arriving from various detectors in a single time channel allows more rational use of the buffer memory. (4 refs.) (tr-SJR)

14228 (JINR–13-7387) FAST 512-CHANNEL AMPLITUDE-TO-DIGITAL CONVERTER IN THE CAMAC STANDARD. Basiladze, S. G.; Man'yakov, P. K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1973. 9p. (In Russian). INIS.

A 512-channel amplitude-to-digital converter for work with pulses of negative polarity is described. The dynamic range is 0.02 to 6 V and the minimum pulse length is 100 nsec. The maximum conversion time is 8 μsec and the integral nonlinearity is 0.2%. The converter was developed in the High Energy Laboratory of JINR. (tr-auth)

14229 (SGAE-2350) VERSATILE LIQUID HELIUM COOLING STAGE FOR THE TRANSMISSION ELECTRON MICROSCOPE. Hoerl, E. M. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Forschungszentrum). Sep 1974. 8p. (CONF-740853-1; ME-62/74). Dep. NTIS (US Sales Only) $4.00.

From 8th international congress on Electron Microscopy; Canberra, Australia (25 Aug 1974).

A versatile liquid helium cooling stage for the transmission electron microscope was constructed. It can be used in the temperature range between 4.2° and approximately 2°K for a great variety of in situ experiments, for instance for studies of solidified permanent gases, irradiation experiments applying nuclear particles or investigations for which a horizontal magnetic field is necessary. (WHK)

14230 (TID-26614) CAMAC: A MODULAR INSTRUMENTATION SYSTEM FOR DATA HANDLING. Specification of Amplitude Analogue Signals Within a 50 Ω System. (USAEC, Washington, D. C.). Oct 1974. 13p. Dep. NTIS $4.00. GPO $0.65.

CAMAC is a design for modular equipment systems used on-line with digital processors and computers and incorporates a comprehensive data transfer highway (Dataway). The CAMAC system, as defined in Report TID-25875, is primarily for on-line use with digital controllers or computers. This document specifies single-ended unipolar and bipolar amplitude analogue signals which are recommended for CAMAC compatible units as used in a 50 Ohm transmission system. It includes and extends the specifications of the previous version, EUR 5100 (1972), and has been the result of close cooperation between the US NIM Committee and the ESONE Committee. Except for page 1, this report is identical to EURATOM Report EUR 5100 (1974). (auth)

14231 (WANL-EOM–025) NERVA SUPPORT EQUIPMENT OPERATION AND MAINTENANCE INSTRUCTIONS. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jun 1965. 97p. Dep. NTIS $8.00.

Information is provided for the operation and maintenance of the portable transducer test equipment. The transducer tester is provided to pre-check the performance of transducers (pressure transducers, thermocouples, LVDT's and accelerometers) used in testing the NRX engines. (TFD)

14232 (WANL-TME-284) EVALUATION HISTORY SHEETS FOR THERMOCOUPLES. Resistance Thermometers and Strain Gages. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1962. 12p. Dep. NTIS $4.00.

Test data on strain gages and thermocouples which are being considered for use in the WRX-A Reactor Hot Tests are outlined. (WHK)

14233 (WANL-TME-1456) OPERATIONAL MANUAL FOR TEST STAND CONTROL SYSTEM XE PULSE AMPLIFIER (938J076G01). Bush, N. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 29 Jun 1966. 29p. Dep. NTIS $4.50.

The XE Pulse Amplifier is a rack-mounted, wholly self-contained transistorized instrument for application in Test Stand Startup Nuclear Instrumentation. The pulse amplifier is an adjustable gain, wide band, amplifier with integral power supplies for operation from a 117V ac power source. This operational manual contains the general description, theory of operation, alignment procedures, maintenance and repair data for the XE Pulse Amplifier. (WHK)

14234 (WANL-TME-1500) WANL CALIBRATIONS FOR XECF. Burlas, T. C.; Karako, E. F.; Pastore, R. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 18 Oct 1966. 67p. Dep. NTIS $6.50.

Calibration data on WANL instrumentation installed on the XECF reactor are given. Copper/Constantan thermocouples, strain gage torque transducers, piezoelectric accelerometers, and pressure transducer calibration data are given. (WHK)

14235 THE USE OF MONOCRYSTALLINE FIBRES IN NEUTRON DIFFRACTION EXPERIMENTS. Zeilinger, A. (Atominstitut der Oesterreichischen Hochschulen, Vienna). Nucl. Instrum. Methods; 120: No. 3, 525-526(15 Sep 1974).

The use of fibers with well defined crystalline properties in monochromators for neutron diffraction work is discussed. Combined with position-sensitive detectors an energy-analyzing system can be constructed. (auth)

14236 ENERGY-DISPERSIVE FLUORESCENCE ANALYSIS USING BRAGG-REFLECTED POLARIZED X-RAYS. Aiginger, H.; Wobrauschek, P.; Brauner, C. (Atominstitut der Oesterreichischen Hochschulen, Vienna). Nucl. Instrum. Methods; 120: No. 3, 541-542(15 Sep 1974).

Using Bragg-reflection at $2\vartheta = 90°$ increases the intensity of polarized exciting radiation in fluorescence analysis. This monochromatic and polarized radiation offers a higher sensitivity compared with previous methods using polarized x-rays. (auth)

14237 DIGITAL COLOR DISPLAY. Kwakkel, E.; Pebesma, J. S. (Instituut voor Kernphysisch Onderzoek, Amsterdam (Netherlands)). Nucl. Instrum. Methods; 121: No. 1, 13-16(1 Oct 1974).

This article describes the design of a color-display system, using unmodified commercial TV equipment, for accelerator control and data display. The prototype has been operating for several months. The main parts of the system are explained, and some of the results are shown. (auth)

14238 STATISTICHESKIE METODY ANALIZA SLUCHAINYKH SIGNALOV V YADERNOFIZICHESKOM EKSPERIMENTE. (Statistical Methods of Random Signal Analysis in Nuclear Physics Experimentation). Chernyavskii, A. F.; Beketov, S. V.; Potapov, A. V. Moscow; Atomizdat (1974). 352p.

Section 1 of this book deals with the elements of the theory of estimating signal parameters in the presence of disturbances. It includes a statistical description of signals and disturbances; an estimate of random parameters in the presence of complete apriori information; an estimate of nonrandom parameters (the case of incomplete apriori information); potential accuracy of signal parameter estimates; estimate in the presence of interfering parameters; an estimate of signal parameters which are functions of time; linear estimates of signal parameters; nonoptimal methods of estimating parameters. Section 2 deals with methods of multichannel time analysis which includes: features of operating a multichannel time analyzer in the presence of random signal fluxes at the inlet; selecting the structural arrangement for handling random signal fluxes at the inlet; most probable estimate of the time position of a pulse; basic practical methods of determining and recording the time position of signals; analogue and pulse methods of converting time intervals to a digital code. Multichannel amplitude analysis (section 3) includes: signal formation at the inlet of a multichannel amplitude analyzer; method of converting pulse amplitudes to a digital code, and stabilization of multichannel analyzer. Section 4 deals with methods of separating weak periodic signals from noise, and includes: analogue systems with averaging of separate elements of a signal (stroboscopic method); synchronous detection; analogue systems with parallel averaging of all elements of a signal; digital method of filtering periodic signals; establishing the form of a quasiperiodic signal in the optical range of wavelengths. (521 refs.) (SJR)

ISOTOPE AND RADIATION SOURCE TECHNOLOGY

Isotope Separation (Industrial)

Refer also to abstracts 13826 and 15796.

14239 (CONF-741086-10) URANIUM ENRICHMENT USING PLASMA CENTRIFUGES. Sabri, Z. A. (Iowa State Univ. of Science and Technology, Ames (USA). Engineering Research Inst.). Sep 1974. 4p. Dep. NTIS $4.00.

From American Nuclear Society national meeting; Washington, District of Columbia, USA (27 Oct 1974).

A viable separation technique for nuclear fuel processing and uranium enrichment akin to the widely noted gas centrifuge process is analyzed. The technique is based on transforming the feed material to plasmas and putting the plasma into rotation by means of a crossed electric and magnetic field. Mechanical limitations of moving parts do not exist and thus centrifugal accelerations unattainable in conventional centrifuges can be achieved. In contrast to earlier electromagnetic separation techniques, separation by plasmas does not involve problems of space charge forces, spread of velocity distribution, and neutralization. Reported collection rates in laboratory rotating plasmas are as high as 100 amperes using a probe with a surface area of 1 cm^2. High degrees of ionization are not required since ionized particles would exert a volume centrifugal force on the neutral particles putting them in rotation and consequently low energy expenditure can be assured. Two types of rotation plasma devices are considered: an isorotational device in which the angular velocity of rotation, Ω, is space-independent and a device for which the ratio between the energy put into the rotation of a unit mass and the thermal energy per particle, θ, is constant. Separation factors are calculated for both situations. (TFD)

14240 (COO-3581-2) STABLE ISOTOPE STUDIES. Progress Report, August 1, 1973–July 31, 1974. Spindel, W. (Yeshiva Univ., New York (USA). Belfer Graduate School of Science). 31 Jul 1974. Contract AT(11-1)-3581. 22p. Dep. NTIS $4.25.

A good deal of effort was expended on the selection, ordering, installation, testing of lasers and associated optical components and infrared detectors during the reporting period. Experimental studies on the spectroscopy of NOCl, both normal and isotopically labelled with ^{15}N were initiated, and the preliminary experimental results obtained to-date, together with preliminary observations of laser-induced infrared fluorescence from vibrationally excited NOCl molecules are described. (TFD)

14241 (FRNC-TH-507) URANIUM VAPOR PRODUCTION AND INTERACTION WITH AN INFRARED RADIATION. Roussel, C. (Grenoble-1 Univ., 38 (France)). [nd]. 125p. (In French). Dep. NTIS (US Sales Only) $9.25.

Thesis.

A uranium isotope separation process is studied. It consists in exciting in a monoatomic uranium vapor, the electronic levels of the isotope 235 alone. The technique utilized to obtain the uranium vapor is described, particularly the tests carried out to obtain a dense and clean vapor, by levitation, by induction heating in cold crucible, or by heating in hot crucibles in tungsten. The injection laser performances are presented together with the method used to separate the vapor flux from the liquid bath radiation. A model is established to give an excitation level population distribution from emission line intensities. The results obtained are only orders of magnitude owing to the lack of accuracy in estimating a line intensity and the problem of line width for intense lines. (FR)

14242 (K-GD-1145) ANALYSIS AND CALCULATION OF SPECIES SEPARATION IN A SUPERSONIC FLOW OF A BINARY GAS MIXTURE THROUGH A CURVED SHOCK WAVE. Harris, W. L. (Massachusetts Inst. of Tech., Cambridge (USA)). Sep 1974. 28p. (CONF-741214-2). Dep. NTIS $4.50.

From workshop on gas dynamic problems in isotope separation; Albuquerque, New Mexico, USA (4 Dec 1974).

For Oak Ridge Gaseous Diffusion Plant, Tenn.

Technical accomplishments in efforts to synthesize existing theoretical models of shock wave phenomena in order to predict species separation in gas mixtures in supersonic flow through curved, two-dimensional shock waves are summarized. The results are consistent with the structure of the shock being governed by the Navier–Stokes equations. The implication being, in this case, that the flow is not rarefied. The results are not limited by mass ratio nor mole fraction of the species in the binary mixture. The species are assumed to be non-reacting (chemically inert). (auth)

14243 (K-OA-2604) AERODYNAMIC SEPARATION SCHEMES: AN OVERVIEW. Von Halle, E. (Oak Ridge Gaseous Diffusion Plant, Tenn. (USA)). 16 Dec 1974. Contract W-7405-eng-26. 14p. (CONF-741214-1). Dep. NTIS $4.00.

From workshop on gas dynamic problems in isotope separation; Albuquerque, New Mexico, USA (4 Dec 1974).

Economic requirements of aerodynamic isotope separation processes before they could replace the gaseous diffusion process are discussed. The processes include: separation nozzle, sonic impact probe or Fenn process, diffusion into a jet, crossed molecular beams, and vortex tubes. Technical data on the processes are not included. (TFD)

14244 (REG/G-4.9(12-74)) PREPARATION OF ENVIRONMENTAL REPORTS FOR COMMERCIAL URANIUM ENRICHMENT FACILITIES. (USAEC Directorate of Regulatory Operations, Washington, D. C.). Dec 1974. 30p. DRS Free.

Prior to the issuance of a license authorizing uranium enrichment facility construction or operation, the Atomic Energy Commission is required to assess the potential environmental effects of the proposed activities in order to assure that issuance of the license is consistent with the national environmental goals as set forth by the National Environmental Policy Act of 1969. In order to obtain information essential to this assessment, the Commission requires each applicant for a license to submit a report on the potential environmental impact of the proposed plant and associated facilities. The purpose of this guide is to provide assistance to applicants for the development of environmental reports addressed to the construction, operation, and decommissioning of uranium enrichment facilities. (TFD)

14245 (REG/G-5.45(12-74)) STANDARD FORMAT AND CONTENT FOR THE SPECIAL NUCLEAR MATERIAL CONTROL AND ACCOUNTING SECTION OF A SPECIAL NUCLEAR MATERIAL LICENSE APPLICATION (INCLUDING THAT FOR A URANIUM ENRICHMENT FACILITY). (USAEC Directorate of Regulatory Standards, Washington, D. C.). Dec 1974. 56p. DRS Free.

This Standard Format has been prepared to provide uniformity and completeness in the preparation and review of the special nuclear material control and accounting section of license applications, to minimize lost time attributable to incomplete applications, and to standardize the licensing review process. (TFD)

14246 (UCRL-75886) LASER ISOTOPE SEPARATION. Dubrin, J. W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Nov 1974. 25p. (CONF-741227-1). Dep. NTIS $4.25.

From southwest regional ACS meeting; Houston, Texas, USA (9 Dec 1974).

An overview of laser isotope separation is presented. Emphasis is given to its potential for uranium isotope separation. (TFD)

14247 (UCRL-76042) LASER ISOTOPE SEPARATION. Snavely, B. B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 4 Dec 1974. 25p. (CONF-741225-1). Dep. NTIS $4.25.

From annual meeting of the division of electron and atomic physics; Chicago, Illinois, USA (4 Dec 1974).

General processes for the separation of isotopes based on vapor phase photophysics and photochemistry are described. The conditions which must be met in order to realize laser photoseparation are discussed. A laser photoseparation experiment to separate uranium isotopes is discussed. (TFD)

14248 D_2O PLANTS DEMAND NEW SENSORS. Can. Chem. Process.; 58: No. 10, 24-25(Oct 1974).

Increased demand for heavy water has resulted in increased emphasis on constant monitoring and control of the GS process in an attempt to approach design capacity. Variations from optimum temperatures, flow rates, and pressures may mean a substantial yearly loss of heavy water. Improved monitoring techniques include the use of acoustic transducers, gamma scanning, and on-line mass spectrometry. (CA)

14249 HEAVY WATER OUTPUT NOW ON TRACK. Can. Chem. Process.; 58: No. 10, 22; 24(Oct 1974).

To meet the needs of an expanding CANDU reactor program, Canada plans to be operating ten heavy water extraction units by 1980. There will be a need for even more heavy water plants if AECL gains a sizeable export market for the CANDU reactor. Rising capital and energy costs will probably drive the price of heavy water up to $100/kg or higher. (CA)

Isotopic Power Sources

14250 (COO-2155-13) BIOMEDICAL ENGINEERING SUPPORT. Kolff, W. J. (Utah Univ., Salt Lake City (USA). Inst. for Biomedical Engineering). 1974. Contract AT(11-1)-2155. 149p. Dep. NTIS $10.50.

Research progress at Utah University during the period Aug. 16, 1973 to Aug. 15, 1974 on the development of an artificial heart is reported. A total of ten heart replacement experiments in calves was conducted using the Bench Model Blood Pump. Both an externally and internally (in the abdomen) located electric motor was used to drive the blood pump. The ultimate goal is to develop a fully implantable artificial heart for humans powered by a ^{238}Pu heat source. (TFD)

14251 SPACECRAFT WASTE MANAGEMENT SYSTEM USING RADIOISOTOPE HEATERS. Shivers, R. W. (Atomic Energy Commission, Washington, DC); Murray, R. W. pp 1287-1293 of International Symposium on Space Technology and Science. Tokyo; AGNE Publishing, Inc. (1973).

From 10th international symposium on space technology and science; Tokyo, Japan (3 Sep 1973).

A system representing the first integrated approach to the waste and water management problem for advanced space vehicles is described. The unit collects and processes the human wastes from four men, including urine, feces, wash water, and trash, recovers the water, and disposes of the solid wastes. The processes utilized are distillation at 49°C and catalytic oxidation at 649°C to purify the water, and incineration at 649°C to dispose of the solids. Electrical power requirements are minimized by use of a specially developed radioisotope heater of 420 W for the high temperature processes and a modified 850-W heater for the distillation process. (auth)

Radiation Sources

14252 RADIOACTIVE ISOTOPES AND FISSION PRODUCT MIXTURES AS RADIATION SOURCES. Chapter II. Kimel, L. R.; Mashkovich, V. P. pp 13-51 of Zashchita ot Ioniziruyushchikh Izhuchenii. Moscow; Atomizdat (1966). (In Russian).

This chapter of the handbook collects and systemizes the data on the most widely used radioactive beta and gamma emitters and ^{235}U fission products used as radiation sources. Numerical values are presented on the half-life and energy spectrum of the radiation: the energy of the beta particle and gamma quanta and the number of beta particles and gamma quanta of each energy for each nuclear disintegration; the differential and total ionization and energy gamma-constants, and the intensity of the bremsstrahlung radiation from a source. For ^{235}U fission product mixtures, numerical values are presented on the specific activity, the specific gamma-equivalent and the effective spectral composition of the radiation as a function of the time of irradiation, cooling time and reactor power. The handbook can be useful to all those working with radioactive materials and sources of ionizing radiation. (tr-SJR)

Design and Fabrication

14253 SAFETY SYSTEM FOR TARGET IRRADIATING DEVICE. Perraudin, C. (to Thomson-CSF). US Patent 3,845,310. 29 Oct 1974. Priority date 13 Apr 1971, France. 4p.

A safety system for switching off an irradiation system when the desired irradiation dose has been exceeded is described. It comprises two ionization chambers through which a particle beam issued from the radiation source propagates, each chamber supplying a radiation monitor. Those monitors supply two parallel connected comparators which operate contact breakers connected in series in a safety circuit controlling the irradiation system. (Official Gazette)

14254 ELECTROMAGNETICALLY CONTROLLED SHIELD AGAINST BETA RADIATION. Heller, J. Czech Patent 146928. 28 Feb 1972. 3p. (In Czech).

The design is described of an electromagnetically controlled beta radiation shield consisting of two non-aligned collimators, a tube collimator in which the radioisotopic beta radiation source is placed, an output collimator, and a torroidal electromagnet equipped with electric power supply leads. The collimated beta radiation beam emitted by a plane source is conducted in between the shielded electromagnet pole pieces. The beta source is shielded and is placed in the collimator. The entire device is housed in a cover having normal laboratory atmosphere. (INIS)

Industrial Uses

Refer also to abstracts 14291 and 14294.

14255 (BFL-1/1974) LONG-TERM FEEDING STUDY FOR TESTING THE WHOLESOMENESS OF AN IRRADIATED DIET WITH A HIGH CONTENT OF FREE RADICALS. II. Renner, H. W. (Bundesforschungsanstalt fuer Lebensmittelfrischhaltung, Karlsruhe (F.R. Germany)). 1974. 21p. (In German). INIS.

In an earlier report a multigeneration feeding study was described, in which rats were fed a diet containing 65% Altromin and 35% milk powder, either unirradiated or irradiated with a dose of 4.5 Mrad. The continuation of this study up to the F_3 generation is reported. From the F_2 generation on, half of the animals in both experimental groups were given drinking water supplemented by a multivitamin preparation. Neither increase in body weights up to 1 year, nor organ weights, nor reproductive performance showed the irradiated diet to have any detrimental effect. In males fed the irradiated diet, the vitamin supplement led to a significant increase in the average body weights after one year of feeding. (auth)

14256 (INS-R-120) NUCLEAR SCIENCE AIDS INDUSTRY. Rafter, T. A. (Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Physics and Engineering Lab.). Feb 1973. 33p. INIS.

An account of some of the applications of nuclear science to industry in New Zealand is presented. Examples discussed are: abrasion testing in the paper industry, density measurements at the Kapuni Natural Gas Plant, testing for leaks in heat exchangers at the Marsden Point refinery, determination of the origin of water flowing into the Lake Manapouri tunnel by measuring its tritium concentration, bromine determinations in the tire manufacturing industry, wood density determination for the Forestry Service, analysis of nitrogen in steel and oxygen in aluminium welding rods by charged particle activation, use of radioisotopes for determining sewage dilution and dispersion patterns, radiosterilization of medical products, possible radiosterilization of food, use of radiation for making wood plastics, for curing paint and for cross-linking plastics, assistance with prospecting by determining age of rocks and temperatures at which they were formed, and investigation of uranium ores. (INIS)

14257 (INS-R-121) REFINERY HEAT EXCHANGER LEAK TEST USING KRYPTON-85. McCabe, W. J.; Pohl, K. P.; Rowse, O. J. (Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Physics and Engineering Lab.). Apr 1973. 17p. INIS.

The heat exchangers associated with the petroleum reforming system at the Marsden Point oil refinery were inspected for leaks using the radioactive tracer krypton-85. Any such leaks were established to be less than 1% of the total throughput. (auth)

14258 (LIE/Trans-525) EXPERIMENTAL IRRADIATION PLANT FOR MAKING SEWAGE SLUDGE HYGENIC. Motsch, H.; Sub, A. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). 1974. Translated from Abawassertechnik; 6: 2-4(1973). 8p. INIS.

A description is given of an industrial plant which uses ionizing radiation to purify sewage. Gamma radiation from ^{60}Co rods is used to kill bacteria and parasites in the sewage sludge. Safety, cost, and expected advantages from irradiation are discussed. (INIS)

14259 (SGAE-2197) LEAK DETECTION ON A SLOP PIPELINE AT AN ETHYLENE PRODUCTION PLANT. Riedlmayer, L.; Riesing, J.; Muehldorf, V. (Oesterreichische Studiengesellschaft fuer Atomenergie G. m. b. H., Vienna). Nov 1973. 4p. (IA-32/73). INIS.

A method of detecting leaks in gas pipes embedded in soil is described. In particular, the application to a slop pipe nonsealable for safety reasons is illustrated. The leak search is based on the application of a radioactive tracer (in this case ethylene bromide) which evaporates in the pipe and upon passing through a leak condenses in the surrounding soil. The radiation emitted by the tracer is detected by scintillation probes and the leak thus located. (auth)

14260 (SGAE-2270) STUDY OF MATERIAL TRANSPORT IN THE COOLING DRUM OF ROTARY CEMENT KILN. Roetzer, H.; Muehldorf, V. (Oesterreichische Studiengesellschaft fuer Atomenergie G. m. b. H., Vienna). Apr 1974. 21p. (In German). (IA-35/74). Available from the OeSGAE, Vienna.

Investigations were carried out in the cooling drum of a rotary cement kiln for the purpose of studying the material transport with respect to the grain size of the cement clinker. Fractions of certain grain sizes were labelled by direct irradiation with thermal neutrons in a reactor, where the traces of manganese contained were activated. The investigations were then performed such that the labeled material was introduced at the hot end of the drum and then the radiation penetrating the walls of the drum

were detected with scintillation probes. These scintillation probes were protected against thermal radiation from the drum by shielding and air cooling. Five experiments were carried out with grain size fractions of 10 to 15 mm, 2.75 to 4 mm, 0.5 to 2 mm, 1.6 to 2 mm, and 0.5 to 1 mm particle diameter. It was found, that for the fine-grained components of the clinker in comparison to the coarse-grained portions backmixing was much stronger and the time of passage heavily increased. (auth)

14261 APPLICATION OF SOFT BETA-RAY METHOD TO DETECTION OF SERVICE LIFE OF SILICONE COMPOUND-TREATED INSULATOR. Garan, S. (Railway Technical Research Inst., Tokyo). Denki Gakkai Ronbunshi, B; 92: No. 12, 656-663(Dec 1972). (In Japanese).

The silicone compound (KS63G) coated insulator was soiled artificially with polishing powder, polishing powder containing 10% sodium chloride, cement powder, carbon black powder or copper powder, and correlation between amoeba action of the silicone compound and the water-repellency or insulating ability was examined. The soft β-ray method was applied to measure decrease of amoeba action. $Ca^{14}CO_3$ powder (1 mg) was sprayed on the soiled silicone compound surface (0.5 mm thick) and the time variation of the intensity of β-rays from the RI powder was measured. In all cases, as the amount of soiling material increases the rate of decrease of β-ray intensity becomes slower showing decrease of the amoeba action. The β-ray intensity after 30 minutes was in the order of copper powder (~70% of the initial intensity); cement powder (80%); polishing powder + NaCl (85%); polishing powder (89%); and carbon black (~95%) for 20 mg of each soiling material. No definite correlation was found between the amoeba action and water-repellency. The relation of amoeba action to insulating ability was strongly dependent on the character of the soiling material. It was concluded that the ordinary GM counter is useful for the on-the-spot detection of service life of silicone compound-treated insulators. The sampling methods, without taking off the insulator from its working position, were developed and found to be useful to obtain information on soiling condition and service life of the insulator indirectly. (JA)

14262 THE SAFE APPLICATION OF RADIOISOTOPES IN SOUTH AFRICA. Basson, J. K. (Atomic Energy Board, Pelindaba, Pretoria (South Africa). Isotopes and Radiation Div.). Nat. Saf. (S. Afr.); 24: No. 1, 18-19(Jan 1974). (In Afrikaans). 3 refs.

The technological applications of radioisotopes in South Africa are reviewed. Radioisotopes are used in medicine as well as by industrial, scientific and educational organizations, state departments and local authorities. Reference is made to the harmful effects of radiation. To ensure the safe application and radiation protection in South Africa all radioactive material is under the statutory control of the Atomic Energy Board. (INIS)

14263 DETERMINING THE DEGREE OF CLEANING MILK UTENSILS AND EQUIPMENT WITH USE OF ISOTOPE TECHNIQUE. Vrigazov, A.; Gromkov, N.; Dimov, G.; Todorov, D.; Stoyanov, S. Vet. Med. Nauki (Sofia); 10: No. 1, 15-24(1973). (In Bulgarian).

^{32}P-labelled sodium phosphate and ^{32}P-labelled suspension of St. aureus-M and E. coli-5 were used to contaminate bottles with milk, jars with yoghurt, container with yoghurt, rubber hoses, and pieces of sheeting and dungaree. The effect of washing and disinfection, as organized at the State Commercial Enterprise "Serdika" was demonstrated by radiometric, autoradiographic and microbiologic techniques. The microbiologic study of the washings from containers following cleaning treatment showed no test organisms. Radiometrically, the washings from some of the containers, especially after the contamination of the latter with St. aureus suspensions, showed negligible radioactivity. The autoradiograms, more often from big yoghurt containers, rubber hoses, and in single cases from bottles and jars, spoke of certain degree of contamination—from single traces to large foci of residual radioactivity. This points to the fact that the mechanical washing procedures do not always prove effective in eliminating the dirt from the containers. (auth)

LIFE SCIENCES

14264 COMPARATIVE RADIOBIOLOGY: IONIZING VERSUS NONIONIZING RADIATIONS. Latarjet, R. (Institut du Radium, Paris). pp 101-108 of Roscoff School on Photobiology. Paris; Centre National de la Recherche Scientifique (1973). (In French).

From Roscoff school of photobiology; Roscoff, France (8 May 1972).

Following the mention of some points of convergence in the development of photobiology and radiobiology, the biological effects of ionizing and nonionizing radiations are compared. First of all the differences are analyzed: photobiology is natural, radiobiology artificial; the former deals with surface phenomena, the latter with reactions in depth. A paragraph is devoted to water, an absorber for ionizing radiations, then the comparative yields of ionizing radiations and photons are studied. The similarities are analyzed next. Similarities in chemical reactions: in nucleic acids the same sites are vulnerable to ionizing radiations and UV photons. The radiation products are different but the biological consequences of these deteriorations are entirely comparable. Similarities in the healing of lesions, which is equally efficient for uv-produced lesions as for those caused by ionizing radiations. Although the lesions and hence the repair mechanisms are different, in general the resistance to both types of radiation varies similarly. (FR)

Radiation Effects on Biochemicals

Refer also to abstracts 14313 and 14320.

14265 (COO-3521-122) BIOLOGICAL EFFECTS OF RADIATION AND RELATED BIOCHEMICAL AND PHYSICAL STUDIES. Proposal 1. Radiation Studies. Progress Report, May 1, 1970–May 1, 1971. Laughlin, J. S.; Pullman, I.; Kessaris, N. D. (Sloan-Kettering Inst. for Cancer Research, New York (USA)). 30 Sep 1971. Contract AT(30-1)-910. 14p. Dep. NTIS $4.00.

Studies on free radical production in biologically significant compounds included the following research programs: irradiated purine N-oxides and studies on the interaction between the mineral and organic components of bone. Theoretical investigations of electron LET spectra and dose relationship for ionizing radiation included studies on high intensity pulsed radiations and LET and RBE studies in water for cyclotron-produced neutron beams. (HLW)

14266 (COO-3521-126) BIOLOGICAL EFFECTS OF RADIATION AND RELATED BIOCHEMICAL AND PHYSICAL STUDIES. Proposal 5. Chemical and Biological Studies on Nucleic Acids and Derivatives. Progress Report, July 1, 1970–June 30, 1971. Brown, G. B.; Bendich, A. (Sloan-Kettering Inst. for Cancer Research, New York (USA)). 30 Sep. 1971. Contract AT(30-1)-910. 16p. Dep. NTIS $4.00.

Progress is reported on the following research projects: photochemistry of N-hydroxypurines; photochemistry of N-oxide tautomers of N-oxidized purines; irradiation of 6-methyl purine 1-oxide; and solid-state irradiation of N-hydroxy purines. (HLW)

14267 (COO-3521-127) BIOLOGICAL EFFECTS OF RADIATION AND RELATED BIOCHEMICAL AND PHYSICAL STUDIES. Proposal 6. Physical Chemical Studies on Nucleic Acids and Derivatives. Progress Report, July 1, 1970–June 30, 1971. Petermann, M. L.; Cavlieri, L. F. (Sloan-Kettering Inst. for Cancer Research, New York (USA)). 30 Sep 1971. Contract AT(30-1)-910. 9p. Dep. NTIS $4.00.

Studies were conducted on: isolation of subunits of rat liver ribosomes; properties of subunits; the 5S RNA-protein complex; properties of ribosomal proteins; characterization of DNA polymerase by sucrose density gradient sedimentation, gel filtration, acrylamide electrophoresis, and sedimentation equilibrium; Rous sarcoma virus RNA; in vivo DNA replication studies in E. coli membrane attachment of DNA; the control mechanism of DNA replication; SV40 specific RNA; induction of lambda prophage by ultraviolet radiation; genetic control of phage T4 DNA synthesis; and in vivo repair of uv-irradiated DNA. (HLW)

14268 (COO-3521-133) BIOLOGICAL EFFECTS OF RADIATION AND RELATED BIOCHEMICAL AND PHYSICAL STUDIES. Proposal 5. Chemical and Biological Studies on Nucleic Acids and Derivatives. Progress Report, May 1, 1971–30 April 1973. Brown, G. B.; Bendich, A. (Sloan-Kettering Inst. for Cancer Research, New York (USA)). 1973. Contract AT(11-1)-3521. 18p. Dep. NTIS $4.00.

Progress is reported on the following research projects: correlations between chemical properties and oncogenicity of purine N-oxide derivatives; ultraviolet irradiation of N-hydroxypurines in solution; ultraviolet irradiation of purine N-oxides in solution; ultraviolet irradiation of 3-hydroxyxanthines in the solid state; and action of gamma radiation on purine derivative. (HLW)

14269 (COO-3521-134) BIOLOGICAL EFFECTS OF RADIATION AND RELATED BIOCHEMICAL AND PHYSICAL STUDIES. Proposal 6. Physical Chemical Studies on Nucleic Acids and Derivatives. Progress Report, May 1, 1971–April 30, 1973. Petermann, M. L.; Cavalieri, L. F. (Sloan-Kettering Inst. for Cancer Research, New York (USA)). 1973. Contract AT(11-1)-3521. 11p. Dep. NTIS $4.00.

Results are summarized from studies of molecular reactions involved in the biosynthesis of DNA and RNA in bacteria (Escherichia coli) and in cultured mammalian cells. (CH)

14270 (INIS-mf-1489) RADIATION DAMAGE IN ADENINE AND DNA. Effects of Sensitizing and Protecting Agents. van Hemmen, J. J. (Vrije Universiteit, Amsterdam (Netherlands)). 25 Jan 1974. 100p. INIS.

Effects of ionizing radiation on adenine in aqueous solutions were investigated. With the pulse radiolysis method, reactions of the adenine radicals were studied. Electron transfer reactions were shown to occur between the electron adduct of adenine and various electron-affinic compounds. Reconstitution reactions occur in the radiolysis of adenine, both in presence and absence of oxygen. Indications were obtained that the "direct action model" of sensitization is not relevant to pure DNA. It was found that the radioprotective agent cysteamine reacts with DNA radicals, resulting in a decrease of the number of single-strand breaks per molecule. No effect of cysteamine on the number of directly formed double-strand breaks could be detected. The amount of lethal nucleotide damage is not affected by cysteamine, added 1.5 msec after DNA irradiation. (INIS)

14271 A STIMULATING EFFECT ON UV IRRADIATION OF BAC. SUBTILIS TRANSFORMING DNA. Minkova, M. I. (Nauchno-Izsledovatelski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Compt. Rend. Acad. Bulg. Sci.; 26: No. 1, 125-128(1973).

The radiosensitivity of transforming DNA as a function of dose was studied by following the inactivation of tryptophan independence marker in uv-irradiated solutions of either purified or protein-containing DNA from Bac. subtilis. The inactivation curve for purified Bac. subtilis transforming DNA after uv exposure for 1, 5, 10, 15, 20, 30, or 60 minutes exhibited two components: a rapid drop of genetic activity during the first 5 minutes, followed by less rapid inactivation over the next 10 to 60 minutes of irradiation. For 1 and 5 min uv exposure of protein-containing DNA solutions DNA transforming activity clearly evidenced an upward trend. For further exposure times, the shape of the inactivation curve was similar to that of the curve obtained in experiments with protein free DNA solution. (INIS)

14272 INVESTIGATING THE POSSIBILITY OF REPAIRING NORMAL AND 5-BROMURICAL SUBSTITUTED DNA IN VITRO. Daneva, M. A.; Marinova, Ts. I.; Petrova, S. N.; Todorov, S. L. (Nauchno-Izsledovatelski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Compt. Rend. Acad. Bulg. Sci.; 27: No. 1, 105-108(1974).

The action of an extract from M. Lysodeikticus on the biological activity of DNA from B. subtilis irradiated with ultraviolet rays was studied and its effect on normal and BU-sensitized DNA was compared. The biological activity of non irradiated BU-DNA did not differ from that of the normal DNA. The injury of the BU-DNA, however, was greater in comparison with that of the normal DNA. The extract caused partial restoration of the biological activity on irradiation in the normal DNA and in the BU-DNA, the latter being influenced to a smaller extent. (INIS)

14273 BIOLOGICAL EFFECTS OF UV IRRADIATION OF DNA AND THE REPAIR OF PHOTOCHEMICAL LESIONS. Mennigmann, H. D. (Univ., Frankfurt am Main). pp 33-37 of Roscoff School on Photobiology. Paris; Centre National de la Recherche Scientifique (1973).

From Roscoff school of photobiology; Roscoff, France (8 May 1972).

There are several proofs that DNA is the cellular substance that carries the primary photochemical lesions due to uv irradiation, which will lead to biological effects. But cells can do so to varying degrees. Three ways have been found: reversal of the

radiation product to the undamaged state in situ (photoenzymatic repair); removal of the radiation product from the DNA and reconstruction of the undamaged state (dark repair); first bypassing the radiation product and reconstruction of an undamaged DNA molecule from redundant information (post replicational or recombinational repair). (FR)

14274 THE INCORPORATION OF WRONG BASES BY DNA POLYMERASE I FOLLOWING GAMMA-IRRADIATION OF DNA-LIKE TEMPLATES. Saffhill, R. (Christie Hospital and Holt Radium Inst., Manchester (UK)). Biochim. Biophys. Acta; 349: No. 1, 23-31(Apr 1974).

The synthesis of polydeoxyribose polymers by Escherichia coli DNA polymerase I was investigated with control and γ-irradiated DNA-like polymer templates containing only two bases. The results show that irradiation of a poly(dA) strand leads to the incorporation of dG, whereas irradiation of poly(dC) and poly(dG) strands both leads to the incorporation of dA. Irradiation of poly(dT) does not lead to the incorporation of any wrong base. The wrong bases are incorporated into the complementary strand of the newly synthesised DNA. (INIS)

14275 STRUCTURAL DAMAGE IN GAMMA-IRRADIATED LYSOZYME. Marciani, D. J.; Tolbert, B. M. (Colorado Univ., Boulder (USA). Dept. of Chemistry). Biochim. Biophys. Acta; 351: No. 2, 387-395(Jun 1974).

The distribution of the different kinetic classes of exchangeable hydrogens were measured for γ-irradiated lysozyme (mucopeptide N-acetylmuramyl-hydrolase, EC 3.4.1.17). Class I hydrogen, associated with fully exposed structures, did not show significant alterations as a function of radiation dose. Class II hydrogen, associated with relatively unhindered peptide groups, showed an increase that is function of radiation dose. Class III and IV hydrogen presented an almost equal rate of decrease that is exponentially related to the dose. The decrease of Class III and IV hydrogens seems to indicate a disruption of structures such as α-helical and β-structures, and destruction of hydrophobic regions, which maintain the tertiary structure of the protein. Difference-spectra studies corroborate these results, presenting the more damaged fractions a higher degree of tryptophan exposure as compared to native lysozyme. Spectroscopic studies in presence of guanidine hydrochloride revealed new chromophore(s) groups that seems to be originated from tryptophan. The relationship between the damage of hydrophobic groups and structural damage is discussed. (INIS)

14276 FREE RADICAL REDUCTION OF FERRICYTOCHROME-C. Simic, M. G. (Univ. of Texas, Austin); Taub, I. A.; Tocci, J.; Hurwitz, P. A. Biochem. Biophys. Res. Commun.; 62: No. 2, 161-167(20 Jan 1975).

Rate constants have been determined for the reduction of ferricytochrome-c by free radicals. k values for pyridinyl radicals, benzoate adduct radicals, nitrobenzene and nitrobenzoate anion radicals, α-hydroxy radicals, formyl anion radical, and superoxide radical show no apparent correlation with size, charge, or structure of the reductant. Some k values change as the pH is increased. The methyl viologen radical is the most reactive; NAD· is reactive; the pentaerythritol radical is unreactive at pH = 7 but moderately reactive at pH = 9; and $O_2^{\cdot-}$ becomes less reactive with increasing pH. The results indicate that several mechanisms for electron transfer are operative and that conformers of differing reactivity influence the kinetics in alkaline solutions. (auth)

14277 EXCISION OF γ-RAY DAMAGED THYMINE BY E. COLI EXTRACTS IS DUE TO THE 5′ → 3′ EXONUCLEASE ASSOCIATED WITH DNA POLYMERASE I. Hariharan, P. V.; Cerutti, P. A. (Univ. of Florida, Gainesville). Biochem. Biophys. Res. Commun.; 61: No. 3, 971-976(11 Dec 1974).

Extracts of E. coli polAexI, which contains a temperature sensitive 5′ → 3′ exonuclease function of polymerase I accomplish the selective excision of products of the 5,6-dihydroxy-dihydrothymine type from γ-irradiated DNA and OsO_4-oxidized polyd(A-T) at the permissive temperature (30°) but not at the nonpermissive temperature (42°). The 5′ → 3′ exonuclease activity of polymerase I, therefore, acts as a repair exonuclease in γ excision repair. (auth)

14278 REJOINING OF RADIATION-INDUCED SINGLE-STRAND BREAKS IN DEOXYRIBONUCLEIC ACID OF ESCHERICHIA COLI: EFFECT OF PHENETHYL ALCOHOL. Nair, C. K. K.; Pradhan, D. S.; Sreenivasan, A. (Bhabha Atomic Research Centre, Trombay, India). J. Bacteriol.; 121: No. 1, 392-395(Jan 1975).

Single-strand breaks in deoxyribonucleic acid of Escherichia coli B/r cells exposed to 20 krads of gamma radiation could be rejoined by incubation of irradiated cells in growth medium. In the presence of 0.25% phenethyl alcohol, this repair was completely inhibited although deoxyribonucleic acid and protein syntheses were suppressed only partially. (auth)

14279 EFFECT OF SCAVENGERS ON RADIATION-SUSCEPTIBLE SITES IN FIBRINOGEN. Kamat, H. N.; Gurnani, S. (Bhabha Atomic Research Center, Bombay). Proc. Indian Nat. Sci. Acad., Part B; 39: No. 4, 528-534(Aug 1973).

From symposium on photochemical and photophysical processes in biological systems; New Delhi, India (27 Jan 1972).

The characteristics of emission and absorption spectra of the irradiated fibrinogen suggest that the aromatic residues of fibrinogen are susceptible to radiation effects. Quantum-yield of the fluorescence decreases progressively with increasing irradiation doses. Although, small decrease in the absorption maximum is noticeable there is proportionate increase in absorption in 240 to 270 nm region as a function of dose of γ irradiation thus, indicating that aromatic residues probably are not degraded but are modified as a result of radiation. Potassium iodide, the OH· radical scavenger prevents this modification and provides protection to the biological activity to the extent of 80 to 90 per cent. Potassium nitrate, the e^- scavenger, protects neither modification nor biological activity. Data clearly indicate that OH· radicals produced as a result of radiolysis of water, attack aromatic side-chains in the fibrinogen molecule. (auth)

14280 ULTRAVIOLET IRRADIATION STUDIES OF DNA FROM MOUSE TISSUES. Ranade, S. S.; Talageri, V. R.; Bhide, S. V. (Cancer Research Inst., Bombay). Proc. Indian Nat. Sci. Acad., Part B; 39: No. 4, 535-540(Aug 1973).

From symposium on photochemical and photophysical processes in biological systems; New Delhi, India (27 Jan 1972).

A comparison of ultraviolet absorption spectra of various DNA preparations from normal and malignant mammalian tissues before and after uv irradiation, was made. DNA samples obtained from tissues of mice treated with urethane were also irradiated and studied. Marked differences in uv spectral absorbance indicative of varied susceptibilities are noticeable at two dose levels of irradiation. However, no correlation between normal and malignant tissue DNAs and their susceptibilities towards uv irradiation was observed. Distinct changes were observed in the shape of absorption curves of the unirradiated samples of both liver DNA and tumor DNA of mice treated with urethane. Significant differences between the normal and tumor DNAs in their response to high dose of irradiation (1.2×10^4 erg/mm^2) were noted. The liver DNA (+ urethane) exhibited marked increase in absorbance at 260 nm, indicative of considerable damage to DNA, whereas the mouse fibrosarcoma DNA (+urethane) showed negligible effect. This observation is thought to be due to the relative stability of the complex formation between urethane and tumor DNA. It is, therefore, suggested that the uv absorption studies may be helpful in distinguishing complex formation of DNA with urethane in normal and malignant tissues. (auth)

Radiation Effects on Cells

Refer also to abstracts 14273, 14340, 14449, and 15843.

14281 (COO-3521-123) BIOLOGICAL EFFECTS OF RADIATION AND RELATED BIOCHEMICAL AND PHYSICAL STUDIES. Proposal 2. Radiation Studies. Progress Report, May 1, 1970–May 1, 1971. Laughlin, J. S.; Djordjevic, B.; Fried, J. (Sloan-Kettering Inst. for Cancer Research, New York (USA)). 30 Sep 1971. Contract AT(30-1)-910. 11p. Dep. NTIS $4.00.

Research on radiation mechanisms in mammalian cells included the following projects: modification of radiation response in synchronized HeLa cells using BUDR; studies with density inhibited cells; effects of high intensity pulsed electrons on mammalian cells; studies on the oxygen enhancement ratio of cyclotron-produced neutrons; and irradiation of HeLa cells with ^{252}Cf sources. (HLW)

14282 (UCSF-10P2-245) EFFECT OF HYPOXIA AND DOSE RATE ON THE SHAPE OF SURVIVAL CURVES FOR EMT6 TUMOR AND B14FAF CELLS IN VITRO. Phillips, T. L.; Fu, K. K.; Kane, L. J. (California Univ., San Francisco (USA)). 1974. 17p. (CONF-740960-4). Dep. NTIS $4.00.

From 6th L. H. Gray conference on initial shapes of cell survival curves; clinical and theoretical implications; London, UK (16 Sep 1974).

Chinese hamster cells and mouse mammary tumor cells grown in vivo and x irradiated and assayed in vitro were used to measure the effects of hypoxia and dose rate on the shape of cell survival curves. In the studies of hamster cells bubbled with gases and irradiated at 100 rads/min, the extrapolation number (n̄) was 11 in air and 1.6 in nitrogen. When sealed ampules were used to create hypoxia and the cells irradiated at 275 rads/min, n̄ was 6.6 for air and 17 for hypoxia. The initial slopes of the survival curves yielded D_0's of 490 rads in air and 2120 rads

under hypoxic conditions. The terminal D_0 values were 173 and 400 rads, respectively. When the dose rate was dropped to 4.5 rads/min, no significant changes in the D_0's were noted. For mouse cells, $\bar{n}$'s of 13.5 in air and 9.8 under hypoxic conditions and terminal D_0's of 139 and 356 rads, respectively, were obtained at 275 rads/min. At 4.5 rads/min there was a significant change in the aerated D_0 to 438 rads and no significant change in the hypoxic D_0. In both cases at the low dose rate $\bar{n}$ dropped to 1.2 to 1.3. The results indicate that the method of producing hypoxia, the cell type, and the dose rate determine the D_0 and $\bar{n}$ values that will be obtained. (auth)

14283 HISTOCHEMICAL STUDIES ON GLIAL CELLS IRRADIATED IN VITRO WITH A 5000 r DOSE OF GAMMA RAYS. Ostenda, M. (Polska Akademia Nauk, Warsaw. Centrum Medycyny Doswiadczalnej i Klinicznej). Neuropatol. Pol.; 10: 413-421(1972). (In Polish).

The following events were observed in glial cells irradiated in vitro with one time 5000 r dose of gamma rays: 1) drop in LDH and SDH activity and in numerous astrocytes the presence of glycogen deposits, 2) in numerous cells, both in astrocytes and oligodendroglia enhancement of acid phosphatase activity, 3) in the later periods after irradiation (72 hrs–7 days) an increase of the number of cells with degenerative changes. These events are indicative of a decreased activity of oxidative processes and enhancement of anaerobic glycolysis in the cells of a higher sensitivity to irradiation. The applied dose may lead to severe damages of the cells, preceded by an increase in activity of lysosomal enzymes and thereafter by degenerative changes. (auth)

14284 STRUCTURAL CHROMOSOME DERANGEMENTS IN LYMPHOCYTES FROM HUMAN PERIPHERIC BLOOD INDUCED BY GAMMA RADIATION FROM ^{60}Co. Todorov, S.; Mileva, M.; Bulanova, M.; Ivanov, B. (Visshi Meditsinski Inst., Sofia (Bulgaria)). Suvrem. Med.; 25: No. 2, 11-14(1974). (In Bulgarian).

By the irradiation of lymphocytes from human peripheric blood in vitro with various doses of gamma rays from ^{60}Co structural chromosome derangements were established, which do not differ qualitatively from those due to other kinds of irradiation of human lymphocytes. Certain quantitative differences however were established by analysis of the chromosome aberrations due to the differences of the applied doses. The statistical analysis of the experimental data on the chromosome fragmentations, dicentrics, interstitial deletions, the cell with structural aberrations, the total number of aberrations, and total number of breaks by the method of the least squares gives evidence of dependence on the dose, which is expressed for the different chromosome derangements by the models $Y = a + b\,D$. When the results from the present data are compared with those obtained by utilization of 180 kV roentgenologic radiation the coefficients for relative biological effectivity (RBE) are about 1 for the chromosome fragments and the cells with structural aberrations. (auth)

14285 EFFECT OF IRRADIATED CELLS ON TUMOR GROWTH. Bray, A. E. (Univ. of Western Australia, Shenton Park). Aust. N. Z. J. Surg.; 44: No. 4, 424-426(Nov 1974).

The effect on tumour growth of adding heavily irradiated cells to a standard number of viable mouse melanoma tumor cells before its inoculation into the syngeneic host was investigated. It was found that admixed irradiated syngeneic tumor cells stimulated tumour growth. Irradiated syngeneic fibroblasts had no effect. Irradiated tumour cells with a strong histocompatability difference inhibited tumour growth. It is possible that this inhibitory effect was due to a stimulation of the host immune system. (auth)

14286 A STUDY OF THE EFFECT OF AET ON DNA AND RNA METABOLISM IN CELL CULTURES. Ivanov, B.; Todorov, S. (Nauchno-Izsledovatelski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Rentgenol. Radiol.; 12: No. 3, 161-165(1973). (In Bulgarian).

The effect of different AET concentrations on cell line Detroit 6 was studied by using primarily the autoradiographic technique for assaying the inclusion of radioactive precursors in DNA and RNA, thymidine ^{3}H and uridine ^{3}H. This, in turn, served to evaluate cell metabolism. The effect on the general morphology of the cell line and on cell division was also analysed. It was found that after overnight treatment of culture AET concentrations higher than 1 mg/ml will abruptly inhibit the cell processes. (auth)

14287 EFFECTS OF IONIZING RADIATION ON RNA METABOLISM IN CULTURED MAMMALIAN CELLS. Enger, M. D.; Walters, R. A.; Campbell, E. W. (Los Alamos Scientific Lab., N. Mex. (USA)). Biochim. Biophys. Acta; 353: No. 2, 227-237(Jun 1974).

During the later portion of the division delay period that follows exposure of cultured Chinese hamster cells to 800 rads ionizing radiation, there is an increased incorporation of ^{3}H-uridine (relative to control cells) into heterogeneous nuclear RNA (HnRNA) and polysomal mRNA without a corresponding increase of incorporation into informosomal messenger-like RNA. The nature of this effect was further investigated. The increased net incorporation reflects an increase in incorporation rate, not a decrease in breakdown; 5-, 10- and 20-min pulses result in the same relative incorporation into HnRNA of irradiated and control cells. The rate of mRNA decay in actinomycin-treated irradiated and control population is comparable. The magnitude of the effect is the same after 800 and 1600 rads. The effect is not apparent when synchronized cells are irradiated in G_1 and the incorporation rates in late interphase of control and irradiated populations are measured. It is concluded that the effect of irradiation on relative rates of uridine incorporation into messenger-related RNAs is a reflection of (1) the fact that the irradiated population is arrested in G_2 (period between end of S (the DNA synthetic period) and beginning of mitosis) while most of an exponential control population is in G_1 (period between mitosis and DNA synthesis) and (2) the incorporation pattern differs in G_2 and G_1, the incorporation into HnRNA and polysomal mRNA being greater relative to that into informosomal messenger-like RNA in G_2 than in G_1. (INIS)

14288 THE EFFECT OF IONIZING RADIATION ON AMINO ACID TRANSPORT SYSTEMS IN THYMOCYTES. Kwock, L.; Wallach, D. F. H. (Tufts-New England Medical Center, Boston, Mass. (USA)). Biochim. Biophys. Acta; 352: No. 1, 135-145 (May 1974).

The radiation effect on K^+ transport was implicated as a cause for the high radiosusceptibility of thymocytes. The effects of radiation (0.05 to 10 krad) on the Na^+-dependent transport of 2-aminoisobutyric acid and the Na^+-dependent transport of 1-aminocyclopentane-1-carboxylic acid and b-2-aminobicyclo(2.2.1)-heptane-2-carboxylic acid were investigated to determine if these transport systems are similarly impaired. Insulin and concanavalin A, which increase 2-aminoisobutyric acid influx by increasing V, protects the thymocyte 2-aminoisobutyric acid system against the effects of radiation. Trypsin, which mimics the effects of insulin in fat cells and hepatocytes was also found to protect the transport system. The results suggest $Na^+ - K^+$ transport and 2-aminoisobutyric acid transport may be coupled in rat thymocytes and that the coupling factor is radiosensitive. This component affects either the rate of substrate turnover, by possible rearrangements of plasma membrane components, or the number of carrier sites. (INIS)

14289 QUANTITATIVE DESCRIPTION OF THE PROCESS OF CELL RADIATION INACTIVATION. V. Inactivation of Cells Due to Radiation of Various LET. Barsukov, V. S.; Malinovskii, O. V. (Radiation Cytology Inst. of Nuclear Physics, Leningrad). Tsitologiya; 16: No. 11, 1397-1401(Nov 1974). (In Russian).

One- and two-track damages in the cell irradiated by charged particles should be distinguished. With increase in LET, the probability of the former damages increases and the probability of the latter reduces. A formula of the dependence of survival on the flow of particles passing through the cell nucleus was suggested on the basis of these probabilities. The formula reflects changes of the dose-survival curve related to LET variation, considers RBE and postradiation modification of effect. (auth)

Radiation Effects on Microorganisms

Refer also to abstracts 14278, 14455, 15841, 15842, 15851, and 15852.

14290 (AD–784243) EFFECT OF ^{60}Co GAMMA IRRADIATION ON STAPHYLOCOCCUS AUREUS. Kudryasheva, A.; Volokhina, M. I.; Emelyanov, I. S. Translated from Vop. Pitan.; No. 1, 72-76(1973). 11p. (FSTC-HT–23-0328-74). NTIS $4.00.

The sensitivity of Staphylococcus aureus to gamma radiation of varying dose rates in a nutrient broth and in a phosphate buffer solution, with and without glucose, was studied. Twenty-four-hour-old microorganisms were irradiated with doses of 20, 40, 60, 80, 100, 200, 300, 400, and 500 krad at dose rates of 4 and 400 rad/sec. An increase in dose rate within the limits studied was found to produce a more effective reduction in number of germs. A dissimilar biological effect of gamma rays of varying dose rates at different integral dose levels was noted. (GRA)

14291 (IAEA-R-973-F) INVESTIGATIONS ON THE INFLUENCE OF DOSE RATE AND ENVIRONMENT ON THE RADIATION RESISTANCE OF HIGHLY RADIATION RESISTANT BACTERIA. Part of a Coordinated Program on the Radiation Sterilization of Biomedical Products. Emborg, C. (International Atomic Energy Agency, Vienna (Austria)). Jan 1974. 9p. INIS.

The project deals with the characterization of radiation-response parameters in the standard bacterial preparations. The studies aim at the development of suitable microbiological monitors for efficiency control of radiation sterilization practices and of the irradiator facilities. The studies involved the use of radio-resistant Str. faecium A_2I and B. sphaericus C_1A strains as well as other contaminant bacteria isolated from medical equipment and dust samples in the premises concerned. The results indicate that ^{60}Co-gamma radiation has a greater inactivating efficiency on dry bacterial standard preparations as compared to an equivalent dose of electron radiation from 10 MeV linear accelerator. The microbicidal effects from the two irradiation sources vary with the irradiation environment such as relative humidity, organic contents and other detailed parameters of the preparation (as aqueous suspension or in serum broth) of those bacterial standard monitors. Combined heat and radiation effects on bacteria indicate some operational advantages in the sterilization practice to justify further accumulation of data. A part of the project's work deals with the intercomparison of the microbiological efficiency of the sterilizing irradiator facilities by using standardized microbial preparations. The utility of such biological monitors in the efficiency calibration of the irradiation sources has been substantiated and their extended continued uses have been recommended. (INIS)

14292 (IBVL-371) STORAGE TESTS WITH IRRADIATED POTATOES (1969–1970). Buitelaar, N. (Instituut voor Bewaring en Verwerking van Landbouwprodukten, Wageningen (Netherlands)). Aug 1970. 8p. (In Dutch). INIS.

Experiments on the sensitivity of irradiated potatoes to disease were conducted by IBVL Wageningen. The 1969/1970 tests were extended on Bintje and Saturna potatoes. Irradiated and chemically-treated tubers were kept in the same storage cell (temperature 9°C, relative humidity 90–95%). The irradiated potatoes were either unsorted, or else had been sorted (and then packed) 4 weeks, 2 weeks or 3 days before irradiation. One batch was neither sorted nor packed. Determination of the percentage of tubers infested with Fusarium, Phoma or Cephalosporium at the end of the storage period resulted in the following conclusions: none of the batches was affected by Phoma; the incidence of Fusarium affection was slight, and no difference was detected between irradiated and chemically-treated tubers; the time elapsed between sorting and irradiation had no effect on the frequency of Fusarium affection; there was a high incidence of Cephalosporium affection, especially in the sorted batches of potatoes. With Bintje, there was no difference between irradiated and chemically-treated tubers, while with Saturna the former were affected significantly more frequently. (NL)

14293 (ORO-3631-5) RADIATION BIOPHYSICAL STUDY OF BIOLOGICAL MOLECULES. Progress Report, August 1, 1973–January 31, 1975. Fluke, D. J. (Duke Univ., Durham, N. C. (USA)). 1975. Contract AT(40-1)-3631. 8p. Dep. NTIS $4.00.

The indicated photoreactivation of dry T_1 bacteriophage subject to the direct action of ionizing radiation was pursued further toward confirmation. Work was continued on the possible participation of superoxide anion in the thiol-dependent oxygen effect of radiation biochemistry. (CH)

14294 (SAND-74-5842) SYNERGISTIC EFFECTS OF HEAT AND IRRADIATION TREATMENT (THERMORADIATION) IN THE STERILIZATION OF MEDICAL PRODUCTS. Trauth, C. A. Jr.; Sivinski, H. D. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 21p. (CONF-741217-1; SM-192/38). Dep. NTIS $4.25.

From symposium on ionizing radiation for sterilization of medical products and biological tissues; Bombay, India (9 Dec 1974).

A generic class of sterilization processes is described in which properly chosen combinations of radiation and heat synergistically inactivate many bacteria and viruses. Treatments with optical combinations are shown to offer the possibility of using lower total doses and lower temperatures than would be required separately for sterilization. This results from easier elimination of heat-labile, radioresistant organisms and radiolabile, heat-resistant organisms and from synergistic inactivation of organisms which are both radioresistant and heat resistant. These processes depend on temperature, dose rate, and time in fairly complex ways; therefore, an analytical framework in which they can be defined is also presented. (auth)

14295 MOLECULAR NATURE OF THE DEOXYRIBONUCLEIC ACID OF A THERMOSENSITIVE R FACTOR, Rts1. DiJoseph, C. G.; Kaji, A. (Univ. of Pennsylvania, Philadelphia). J. Bacteriol.; 120: No. 3, 1364-1369(Dec 1974).

The deoxyribonucleic acid of the thermosensitive R factor, Rts1, was examined by the technique of sedimentation in alkaline sucrose, electron microscopy, and radiation target size. All these methods yielded a molecular weight of approximately 120 million for Rts1 deoxyribonucleic acid in Escherichia coli. Sedimentation analysis revealed that Rts1 deoxyribonucleic acid in Proteus mirabilis was also 120 million daltons. Rts1 did not segregate into E. coli minicells under the conditions where another smaller non-thermosensitive R factor could. (auth)

14296 IN VIVO STUDIES OF TEMPERATURE-SENSITIVE recB AND recC MUTANTS. Kushner, S. R. (Stanford Univ., CA). J. Bacteriol.; 120: No. 3, 1213-1218(Dec 1974).

Some in vivo properties of Escherichia coli K-12 strains carrying recB270 (formerly recBts1) and recC271 (formerly recCts1) mutations have been determined. Single recB270 and recC271 mutants appear normal at 30 C with regard to ultraviolet and mitomycin C sensitivity, recombination proficiency, and viability. At 43 C these strains become sensitive to ultraviolet and mitomycin C, while showing only a slight decrease in recombination proficiency. The viable titers of the single mutants are somewhat reduced at 43 C. Double mutant strains carrying polA1 and recB270 or recC271 are inviable at 43 C. The double mutant strain (recB270 recC271) is sensitive to both uv and mitomycin C at 30 C, but shows only slightly reduced recombination proficiency. At 43 C the strain resembles absolute recB and recC mutants in all respects. In addition, the double mutant strain exhibits a temperature-induced drop in viable titer. The triple mutant polA1 recB270 recC271 is viable at 30 C. Two hypotheses are advanced to explain these results. (auth)

14297 DNA SYNTHESIS IN PRETREATED AND ULTRAVIOLET-IRRADIATED CELLS OF ESCHERICHIA COLI B/r Hcr^+ AND Hcr^-. Brozmanova, J.; Slezarikova, V.; Sedliakova, M. (Cancer Research Inst., Bratislava). Folia Microbiol. (Prague); 19: No. 6, 459-465(1974).

DNA synthesis after the ultraviolet irradiation was followed in the excision proficient strain Escherichia coli B/r Hcr^+, in which the ability to excise thymine dimers was suppressed by a preirradiation inhibition of DNA and protein syntheses and in the excision deficient strain Escherichia coli B/r Hcr^-. Synthesis of pulse-labeled DNA, its stability and semiconservative DNA synthesis were compared in both strains. It was found that cells of the Hcr^+ strain restore semiconservative DNA synthesis and the pulse-labeled DNA appears stable, in spite of the fact that dimers are not excised under these conditions. On the other hand, cells of the Hcr^- strain are unable to restore semiconservative DNA synthesis and the pulse-labeled DNA is degraded. As the repair by the excision of dimers under the used experimental conditions may be excluded in both strains, it is possible to assume that activity of enzymes included in the Hcr^+ marker is prerequisite for restoring the DNA synthesizing system in the Hcr^+ strain. (auth)

14298 MORPHOLOGICAL CHANGES INDUCED BY ULTRAVIOLET RADIATION IN STREPTOMYCES FRADIAE. Deschamps, A.; Plichon, B.; Petitprez, A. (Institut Pasteur de Lille, Villeneuve, France). Compt. Rend., Ser. D; 278: No. 23, 3007-3010(5 Jun 1974). (In French).

Streptomyces fradiae irradiated by ultraviolet rays give rise, on an ordinary agar gel, to colonies that become covered with unusual excrescences after a prolonged period of incubation. The mycelium of the latter when observed under the scanning electron microscope shows an abnormal degeneration followed by total lysis. (FR)

14299 UV-IRRADIATION INACTIVATED TISSUE CULTURE VACCINE AGAINST ECTHYMA CONTAGIOSUM. Saukhney, A. N.; Manolova, N. Kh.; Gagov, I. J. (Bylgarska Akademiya na Naukite, Sofia). Compt. Rend. Acad. Bulg. Sci.; 25: No. 4, 557-560(1972).

The preparation of a tissue culture vaccine against Ecthyma contagiosum of sheep and vaccination trials conducted with it are reported. Comparative study with tissue culture vaccines, untreated or uv irradiated for 20 or 30 minutes, was conducted. Both untreated cell culture viruses and those inactivated by exposure to uv irradiation were quite safe and afforded good protection at 8 weeks post vaccination (longest period tested), whereas the tissue culture virus inactivated by 1% formalin did not protect the vaccinated animals against challenge to virulent virus. The most suitable site for vaccination is the inner surface of the thigh. (INIS)

14300 ISOLATION OF STOCKS OF PARAMECIUM AURELIA OF DIFFERENT RADIOSENSITIVITIES TOWARDS NATURAL IONIZING RADIATION. Croute, F.; Planel, H.; Soleilhavoup,

J. P.; Blanquet, Y. (Univ., Toulouse). Compt. Rend. Soc. Biol.; 167: No. 12, 1984-1989(1973). (In French).

Radiosensitive or radioresistant stocks of paramecíae were isolated during 9 months, and a statistical analysis of the results was made. It was demonstrated that stocks of different radiosensitivities towards natural irradiation could be isolated. (FR)

14301 EFFECT OF GAMMA RAYS ON TRICHOMONAS GALLINARUM, MARTIN, ROBERSON, 1911. Stefanova, M. Vet. Med. Nauki (Sofia); 10: No. 7, 33-39(1973). (In Bulgarian).

Radiometric and cultural studies were carried out to follow up the changes in the reproductive capacity in vitro and the infectivity in vivo of Trichomonas gallinarum (in the viscera of experimentally infected birds). Trichomonas organisms were labelled with radioactive phosphorus, and gamma treatment was affected by means of a QUBE-4000 device (1350 r/min) at rates of 40 to 300 kR. The reproductive capacity of Tr. gallinarum is not affected by gamma treatment within the range of 40 to 160 kR. At 180 kR and up to 300 kR it progressively lowers and disappears at the final rate. Rates of about 100 kR prove most instrumental in retaining of both the reproductive capacity in vitro and the infectivity in vivo. (auth)

14302 ATMOSPHERIC HT AND HTO. I. Experimental Procedures and Tropospheric Data 1968–72. Oestlund, H. G.; Mason, A. S. (Univ. of Miami, FL). Tellus; 26: No. 1-2, 91-102 (1974).

From symposium on trace gases; Mainz, Germany (2 Apr 1973).

A technique was developed for direct field sampling of atmospheric HTO and HT. Airborne, portable, and laboratory versions were implemented, and a comprehensive sampling program was begun. The air is passed first through a molecular sieve to absorb the water, then over palladium carried on a molecular sieve, which oxidizes atmospheric hydrogen and adsorbs the resulting water in situ. Both samples are subsequently extracted from the adsorbers, and the tritium content measured by internal low-level gas counting. Resolution is 4% of present atmospheric levels. Monitoring of HT and HTO at three stations in the Northern Hemisphere shows that HT does not undergo seasonal fluctuations like HTO, and variations are small around the present mean of about 46 HT molecules per mg air. After the previous rise from pre-nuclear level, the tropospheric HT-inventory has reached a steady state within the past few years. Sampling transects from 40°N to 65°S in 1971 and 1972 show similar HT levels in the Northern and Southern Hemispheres indicating a long residence time of HT (and hydrogen). The HT appears to have its source at ground level, most likely from nuclear fuel element processing, underground nuclear fusion device detonations, and military and civilian handling of tritium gas. In the troposphere, there is now more tritium as gas (HT or T_2) than as HTO (water vapor). (auth)

14303 THE DISAPPEARANCE OF ULTRAVIOLET-INDUCED PYRIMIDINE DIMERS FROM THE NUCLEAR DNA OF EXPONENTIAL AND STATIONARY PHASE CELLS OF SACCHAROMYCES CEREVISIAE FOLLOWING VARIOUS POST-IRRADIATION TREATMENTS. Walters, R.; Moustacchi, E. (Institut du Radium, 91405-Orsay (France). Fondation Curie). Biochim. Biophys. Acta; 353: No. 4, 407-419(Jul 1974).

Haploid wild-type cells of both exponential and stationary phase cultures of Saccharomyces cerevisiae are shown to remove from the nuclear DNA only a small percentage of the pyrimidine dimers induced by an incident dose of 5000 ergs mm^2 of ultraviolet light on their post-irradiation incubation in nutrient medium. This removal is enhanced for late exponential and stationary phase cells by a post-irradiation incubation in saline prior to incubation in nutrient medium. Changes in the detectable amounts of such ultraviolet-induced pyrimidine dimers brought about by the application of photoreactivating light following all the forementioned post-irradiation treatments were also monitored. In all instances the cell survival was estimated, an attempt being made to correlate the biochemical and physiological data obtained. (INIS)

14304 STIMULATION OF NON-CONSERVATIVE DNA SYNTHESIS BY ULTRAVIOLET LIGHT IN FREEZE-TREATED BACILLUS SUBTILIS. Hadden, C. T. (Florida Univ., Gainesville (USA). Radiation Biology Lab.); Billen, D. (Florida Univ., Gainesville (USA). Dept. of Radiology); Corrigan, K. (Florida Univ., Gainesville (USA). Coll. of Medicine). Biochim. Biophys. Acta; 324: No. 4, 461-471(Nov 1973).

Ultraviolet irradiation increases the non-conservative incorporation of dTTP into DNA using cells made permeable to ATP and deoxy nucleoside triphosphates by freezing. The role of DNA polymerase I in this incorporation was studied using N-ethylmaleimide as a selective inhibitor of DNA polymerases II and III. Ultraviolet stimulation of dTTP incorporation requires ATP and is sensitive to N-ethylmaleimide. The inhibitor can no longer block the increase in dTTP incorporation if the cells are incubated for 30 min after irradiation before DNA synthesis is allowed. Since N-ethylmaleimide inhibits excision of pyrimidine dimers from the DNA of irradiated cells, it may be that an early step in dimer excision is required for an increase in dTTP incorporation. Because mutants of Bacillus subtilis lacking DNA polymerase I cannot carry out a high rate of dTTP incorporation when assayed in this manner, and because DNA polymerase I is not sensitive to N-ethylmaleimide while polymerases II and III are sensitive, it was concluded that DNA polymerase I very likely catalyzes essentially all of the non-conservative DNA synthesis in both unirradiated and irradiated frozen cells. (INIS)

14305 EFFECT OF CHLORAMPHENICOL AND TETRACYCLINE ON THE PROTEIN SYNTHESIS OF CERTAIN MUTANTS OF E. COLI IRRADIATED WITH UV RAY. Marinova, Ts. I.; Petrova, S. N.; Daneva, M. A.; Todorov, S. L. (Nauchno-Izsledovatelski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Compt. Rend. Acad. Bulg. Sci.; 27: No. 2, 255-258(1974).

The degree to which protein synthesis is inhibited by chloramphenicol and tetracycline in non dividing cells of E.coli and mutants of E.coli irradiated with a constant and impairing dose of uv rays compared with that of non-irradiated cells was studied. The effect on the protein synthesis was read by incorporation of the labelled amino acids L valine ^{14}C and glycine ^{14}C. For the two initial strains of E.coli B and E.coli K 12 a higher resistance of the irradiation cells was observed. At a concentration of 1 γ/ml the inhibition of protein synthesis did not exceed 50 per cent, whereas in the non-irradiated cells it was in all cases higher than that and reached to 80 per cent. At a ten times lower concentration of 0.1 γ/ml the non-irradiated cells show a 20 to 45 per cent impairment of the protein synthesis, whereas in irradiated cells the degree of incorporation is higher than that of the corresponding controls. These phenomena are related to the process of repair taking place in the cell. The results obtained in strains of E.coli of different radiosensitivity are in support of this assumption. (INIS)

14306 STUDIES ON METHIONINE FERMENTATION. I. Selection of Mutants of Micrococcus Glutamicus and Optimum Conditions for Methionine Production. Banik, A. K.; Majumdar, S. K. (Jadavpur Univ., Calcutta). Indian J. Exp. Biol.; 12: No. 4, 363-365(Jul 1974).

In the course of mutation studies with M. glutamicus ATCC 13032 using ethylmethane sulfonate and X-rays, 3 mutants (M. glutamicus X_1, M. glutamicus X_2, and M. glutamicus X_3) were found to accumulate methionine in the culture broth. These mutants were biotin-requiring auxotrophs. Biotin was required both for production of methionine and growth of the organism. Of these mutants, M. glutamicus X_1 was selected as the most potent organism. The optimum cultural conditions for the production of methionine by M. glutamicus X_1 were pH, 7.0; period of incubation, 3 days; temperature, 28°C; volume of medium in 100 ml flask, 25 ml; and volume of inoculum, 0.5 ml of cell suspension containing 5×10^8 cells. Maltose at a level of 5% gave maximum yield of the amino acid. Ammonium nitrate was an excellent nitrogen source for the production of methionine. Ammonium nitrate at 0.8% conc. and biotin at 1 μg/ml gave optimum yield of the amino acid. The medium that supports maximum cellular growth did not, however, give optimal yield of methionine. (auth)

14307 ISOLATION AND CHARACTERIZATION OF AN ESCHERICHIA COLI K-12 MUTANT WITH A TEMPERATURE-SENSITIVE RECA$^-$ PHENOTYPE. Lloyd, R. G.; Low, B.; Godson, G. N.; Birge, E. A. (Yale Univ., New Haven). J. Bacteriol.; 120: No. 1, 407-415(Oct 1974).

A mutation that causes a temperature-sensitive RecA$^-$ phenotype was identified in a derivative of a PolA$^-$ strain that failed to grow at high temperature. The mutant allele (recA200) was shown to be linked to cysC, conferred a sharply temperature-sensitive, ultraviolet-sensitive Rec$^-$ phenotype in the range 35 to 42°C, and in crosses failed to show complementation at 42°C with Hfr's that transferred recA$^-$. Double mutants that carried both recA200 and polA were examined for ability to grow and synthesize DNA at restrictive temperatures. (auth)

14308 LOSS OF PHOTOREVERSIBILITY OF DAMAGE TO DEOXYRIBONUCLEIC ACID REPLICATION IN ULTRAVIOLET-IRRADIATED ESCHERICHIA COLI B/R THY TRP. Doudney, C. O. (Albert Einstein Medical Center, Philadelphia). J. Bacteriol.; 120: No. 1, 394-398(Oct 1974).

Loss of photoreversibility (LOP) of the ultraviolet (uv) damage which prevents reinitiation of deoxyribonucleic acid (DNA) replica-

tion occurred with incubation of Escherichia coli B/r thy trp cultures after uv doses of 240, 320, and 400 ergs/mm². LOP occurred at the time of reinitiation of DNA replication in the cultures (i.e., after postirradiation lag periods of 45 min or more). Neither the absence of thymine nor the absence of tryptophan prevented LOP of the damage to DNA replication, suggesting that neither DNA replication nor protein synthesis is necessary for the process. These findings suggest that attempted initiation of DNA replication results in transformation of pyrimidine damage into permanent damage to chromosome structure at the reinitiation site. (auth)

14309 ULTRAVIOLET SENSITIVITY OF BACILLUS SUBTILIS SPORES UPON GERMINATION AND OUTGROWTH. Munakata, N. (York Univ., Downsview, Ont.). J. Bacteriol.; 120: No. 1, 59-65 (Oct 1974).

A strain of Bacillus subtilis, UVSSP-42-1, which produces ultraviolet (uv)-sensitive spores and vegetative cells, was found to possess germinated spores 25 times more uv resistant than the resting spores. This relative resistance achieved on germination was associated with the transition of the heat-resistant refractile spores to the heat-sensitive phase-dark forms. Several generations of outgrowth were required before the cells attained the level of uv sensitivity characteristic of the vegetative cell. The uv sensitivity of germinated spores was compared with other strains with various combinations of mutations affecting deoxyribonucleic acid repair capabilities. The presence of hcr and ssp mutations which are known to abolish the removal of photoproducts from deoxyribonucleic acid did not alter significantly the sensitivity of the germinated forms. However, the addition of the recA mutation and, to some extent, the pol mutation increased the uv sensitivity of the germinated spores. These results indicate that deoxyribonucleic acid repair mechanisms dependent on the recA gene are active in the germinated spores. The chemical nature of the damage repaired by the recA gene product is not known. This study indicates that the life cycle of sporulating bacilli consists of at least three photobiologically distinct forms: spore, germinated spore, and vegetative cell. (auth)

14310 INTERRELATIONSHIP OF REPAIR MECHANISMS IN ULTRAVIOLET-IRRADIATED ESCHERICHIA COLI. Moss, S. H.; Davies, D. J. G. (Univ. of Bath, Eng.). J. Bacteriol.; 120: No. 1, 15-23(Oct 1974).

Investigation of the effect of photoreactivation, excision, and recombination repair, individually and in combination, on the survival of ultraviolet-irradiated Escherichia coli K-12 mutants has led to a possible explanation of the loss of photoreactivability and of the complex changes in viability observed during liquid-holding. It is suggested that at higher ultraviolet light doses the excision repair mechanism becomes saturated due to overlapping of excised regions on opposite strands of the deoxyribonucleic acid helix. The results also provide support for the existing hypothesis that states that the shape of shouldered survival curves of ultraviolet-irradiated bacteria can be described in terms of the probability of occurrence of overlapping excised regions. Using the data obtained with repair-deficient mutants with closely related genetic makeup, we present a mathematical model that accurately predicts the shape of the observed survival curves and provides an estimate of the number of nucleotides in each fragment of deoxyribonucleic acid removed by the excision repair mechanism. (auth)

14311 TRANSDUCTION AND PLASMID DEOXYRIBONUCLEIC ACID ANALYSIS IN A MULTIPLY ANTIBIOTIC-RESISTANT STRAIN OF STAPHYLOCOCCUS EPIDERMIDIS. Rosendorf, L. L.; Kayser, F. H. (Univ. of Zurich). J. Bacteriol.; 120: No. 2, 679-686(Nov 1974).

A genetic analysis of a multiply antibiotic-resistant strain of Staphylococcus epidermidis was performed. Experiments designed to show reversion of organisms to antibiotic susceptibility, as well as studies of the influence of ultraviolet irradiation of phage on the transduction frequencies of the resistance markers, indicated that determinants of chloramphenicol (cml), tetracycline (tet), and neomycin (neo) resistance are present on separate plasmids, but the streptomycin marker is chromosomal. In 2 to 6% of tetracycline-resistant transductants, co-transduction of cml was also observed. By using CsCl-dye density gradients followed by neutral sucrose gradients, the plasmids carrying cml, tet, and neo could be isolated and their molecular weights could be determined. The tetracycline plasmid is shown to be incompatible with one of the cryptic plasmids of a recipient strain. (auth)

14312 POSITIVE SELECTION OF MUTANTS WITH DELETIONS OF THE GAL-CHL REGION OF THE SALMONELLA CHROMOSOME AS A SCREENING PROCEDURE FOR MUTAGENS THAT CAUSE DELETIONS. Alper, M. D.; Ames, B. N. (Univ. of California, Berkeley). J. Bacteriol.; 121: No. 1, 259-266 (Jan 1975).

A convenient and specific positive selection for long deletions through the gal region of the chromosomes of Salmonella typhimurium and Escherichia coli was developed. Through simultaneous selection for mutations in the two closely linked genes, gal and chlA, a variety of deletions of varying length, some extending through as much as 1 min of the chromosome, could be readily obtained. Many of these deletions resulted in the loss of a gene, named dhb, concerned with the ability of the bacterium to synthesize the iron chelating agent enterobactin. The selection was adapted for the screening of mutagens for their ability to generate long deletions in the bacterial deoxyribonucleic acid. Forty agents were screened for this capability. Nitrous acid, previously reported to be an efficient mutagen for this purpose, increased the frequency of deletion mutations 50-fold in our system. Three others, nitrogen mustard, mitomycin C, and fast neutrons, were shown to increase the frequency of long deletions between five- and eightfold. The remainder were found to be incapable of generating these deletions. (auth)

14313 RADIATION INJURY, REPAIR, AND SENSITIZATION OF MICROORGANISMS. Pradhan, D. S.; Nair, C. K. K.; Sreenivasan, A. (Bhabha Atomic Research Center, Bombay). Proc. Indian Nat. Sci. Acad., Part B; 39: No. 4, 516-527(Aug 1973).

From symposium on photochemical and photophysical processes in biological systems; New Delhi, India (27 Jan 1972).

Both ultraviolet and ionizing radiations are lethal to microorganisms primarily due to distortions in DNA structure. Ultraviolet radiations induce pyrimidine dimers whereas ionizing radiations cause single and double strand breaks in the DNA molecule. Microorganisms possess multienzyme systems which can repair DNA damaged by radiations. Several mutant strains deficient to varying degrees in either one or the other repair enzymes have been available and with the use of these a great deal is being learned on the mechanism of DNA repair. Recent studies indicate that the cell membrane may be involved in DNA repair. Radiation effects can be modified by altering composition of irradiation medium, pre- and post-irradiation treatments, and irradiating cells at different growth phases. The manner in which certain chemicals, when present along with microbial cells during exposure to ionizing radiations increase radiation-induced lethality, was the subject of several investigations. N-ethylmaleimide and certain iodinated compounds were found to enhance lethality of bacteria irradiated under anoxic conditions by increasing radiation-induced strand scissions in DNA. However, sensitization by these chemicals of microorganisms irradiated in the presence of oxygen is due to inactivation of cellular sites other than DNA. The foregoing areas of study are reviewed with special reference to work in progress in the authors' laboratories. (auth)

14314 REVERSIBILITY OF THE ESCHERICHIA COLI $K_{12}SR_{20}$ STRAIN. Krejciova, A. (Inst. of Biology, Bratislava). Biologia (Bratislava); 28: No. 9, 753-758(1973).

A study of the spontaneous and of the uv-induced mutability of the $K_{12}SR_{20}$ E. coli strain showed that out of five studied markers of the $K_{12}SR_{20}$ strain, mutation frequency was most noticeable in the markers Arg^- Arg^+ and Thr^- Thr^+. No mutability could be found in the other markers. In further experiments only the mutability of these two markers was investigated. Increasing the doses of uv radiation resulted in a markedly increased mutation frequency in these two loci. Selective media applied did not significantly affect the frequency of spontaneous and of uv-induced arginine and threonine revertants. (Nucl. Sci. Abstr. Czech)

14315 INFLUENCE OF AMINO ACID STARVATION ON THE REACTIONS OF UV-IRRADIATED ESCHERICHIA COLI $K_{12}SR_{20}$ CELLS. Slamenova, D. (Cancer Research Inst., Bratislava); Krejciova, A. Biologia (Bratislava); 28: No. 9, 759-766(1973).

The effects of pre-irradiation and of post-irradiation amino acid starvation on lethal and mutagenic effects of uv irradiation and on the intensity of DNA degradation in irradiated cells of the E. coli $K_{12}SR_{20}$ strain were studied. Starvation induced before irradiation increased the survival after uv irradiation and decreased the uv mutability and the degree of DNA degradation. Starvation induced after irradiation decreased the survival rate of cells, as well as the mutation frequency and the degree of DNA degradation. With combined pre-irradiation and post-irradiation starvation the number of surviving and mutated cells remained constant and DNA degradation was found to be lowest. The results show that no definite correlation exists between the degree of cell viability in the irradiated culture and the degree of DNA degradation, or the scope of mutability of the culture under investigation. (Nucl. Sci. Abstr. Czech)

14316 INDUCTION OF MUTAGENIC EFFECTS IN E. COLI BY DECAY OF INCORPORATED PHOSPHORUS-32. Pluciennik, H.; Zielinska, M. (Univ., Warsaw). Nukleonika; 18: No. 11, 60-68(1973).

The lethal process and Try^- to Try^+ and Leu^- to Leu^+ reversions

were studied in Escherichia coli Try⁻ Leu⁻ (strain C-43) bacteria, as effected by the decay of incorporated ^{32}P. The lethal efficiency of ^{32}P decay in this study was consistent with the findings of other investigators. Leu⁻ to Leu⁺ reversions occurred at a rate 70 times as high as the frequency of spontaneous reversions. No increase over the spontaneous reversion frequency was found for the Try⁻ to Try⁺ reversion. (ERB)

14317 LETHAL AND MUTAGENIC EFFECTS OF ACRIDINE MUSTARDS IN RADIOSENSITIVE MUTANTS OF SACCHAROMYCES CEREVISIAE. Fedorova, I. V.; Bondarev, G. N. (Leningrad Inst. of Nuclear Physics). Genetika; 10: No. 11, 111-120(Nov 1974). (In Russian).

The mutagenic effect of 2-methoxy-6-chloro-9[3-(ethyl-2-chloroethyl) aminopropylamino] acridine · 2HCl (1) and 2-methoxy-6-chloro-9[3-di-(2-chloroethyl) aminopropylamine] acridine · 2HCl (2) was studied by inducing forward mutations and reversions at the ade-2 locus of Saccharomyces cerevisiae. The results obtained indicate that (1) is a weaker mutagen as compared with (2). The test of complementation of (1)- and (2)-induced mutations in the ade-2 locus shows that two mutagens are highly specific and induce only non-complementation mutations. The mutations to x-ray sensitivity, xrs_1 and xrs_2, did not affect the mutation frequency at the loci ade-1 and ade-2, but xrs_2 increased the sensitivity to the lethal effect of (2). At the same time the mutation to uv-sensitivity (uvs_1) drastically increased mutagenic and lethal effects of (2). (auth)

14318 HYDROCARBON UTILIZING MUTANTS OF SACCHAROMYCES YEAST. VI. Lack of Sporulation, Mating, and Mitotic Recombination in Hyc^c and Hyc$^+$ Mutants. Rabinovich, E. G.; Egorova, V. N.; Smirnova, O. Yu.; Inge-Vechtomov, S. G. (Inst. of Genetics and Industrial Microorganisms, Moscow). Genetika; 10: No. 11, 93-99(Nov 1974). (In Russian).

Sporulation, residual mating ability, and mitotic intergenic recombination were studied in mutants Hyc^c and Hyc$^+$ in comparison with original diploid and polyploid strains Hyc⁻ of Saccharomyces cerevisiae. Each strain was heterozygous for 3 or 4 markers. Sporulation and mating ability were not observed in hydrocarbon utilizing mutants as distinct from strains Hyc⁻. In none of mutants Hyc^c and Hyc$^+$ spontaneous mitotic recombinants were observed among 31,841 clones studied. There was no induction of recombinants among 192,160 clones studied after treatment with 500 erg/mm^2 of uv and among 5583 clones after treatment with 3000 erg/mm^2 of uv. A number of revertants Hyc$^+$ → Hyc⁻ and Hys^c → Hyc⁻ were obtained in the same experiments. They restored the sporulation ability and showed meiotic segregation for all recessive markers of the original strains Hyc⁻. Lack of sporulation, mating ability, and mitotic recombination ability in Hyc^c and Hyc$^+$ mutants was discussed together with other phenotypic traits which characterize the mutants studied. (auth)

14319 BIOLOGICAL PROPERTIES OF ANTIGENS AND CHEMICAL CHARACTERISTICS OF SPECIFIC POLYSACCHARIDES OBTAINED FROM S. TYPHI BACTERIA EXPOSED TO GAMMA IRRADIATION. Shibaeva, I. V.; Izvekova, A. V.; Ivanov, K. K. (Inst. of Epidemiology and Microbiology, Moscow). J. Hyg., Epidemiol., Microbiol., Immunol.; 17: No. 3, 357-363(1973).

Toxicity and the antigenic and immunogenic properties were studied of radioantigens obtained from S. typhi bacteria (strain Ty_2 4446) exposed to gamma irradiation in doses of 0.6, 2.5, and 5 Mrad. The toxicity of the radioantigens decreased with increasing radiation dose. Their antigenic and immunogenic properties as well as the preventive properties of sera to radioantigens did not differ from the properties of preparations obtained from non-irradiated bacteria. Specific polysaccharides were isolated from radioantigens to determine the correlation between the biological activity of the endotoxin and radiochemical changes in its components. The chemical composition of the specific polysaccharides was found to be identical with the composition of the polysaccharides obtained from non-irradiated bacteria. This is suggestive of a comparatively high stability of the polysaccharide component of the endotoxin in the bacterial cell. (Nucl. Sci. Abstr. Czech)

14320 EFFECTS OF IONIZING RADIATION DOSE ON STABILITY OF FATS. Salkova, Z. Bull. Slov. Pol'nohospod. Akad., Vysk. Ustavu Potravin.; 12: No. 2, 3-11(1973). (In Slovak).

In a study into the effect of ionizing radiations on the formation of oxidation products in fats, methyllinoleate, sunflower oil, and pork fat were exposed to doses of 0.1 Mrad to 4.0 Mrad of gamma radiation. The irradiation resulted in an increase in the amount of peroxides, carbonyl compounds, and conjugated dienes. Contrary to literature data, no proportionality was ascertained in the formation of the substances with the doses used. Pork fat was found to be the most radiosensitive out of the three substances. (Nucl. Sci. Abstr. Czech)

Radiation Effects on Plants

14321 (ORO-3918-4) REPAIR OF RADIATION DAMAGE IN NEUROSPORA CRASSA. Comprehensive Report (April 1 1969–March 31, 1972). Terry, C. E. (Emory Univ., Atlanta, Ga. (USA)). 1972. Contract AT(40-1)-3918. 11p. Dep. NTIS $4.00.

Progress is reported in studies of uv radiation damage and repair in Neurospora crassa. (CH)

14322 RADIOSENSITIVITY AND MUTABILITY IN ALFALFA. I. Radiosensitivity in Alfalfa as Influenced by the Gamma-Irradiation Dose. Topchieva, A.; Georgiev, Z. Genet. Selek.; 6: 473-481(1972). (In Bulgarian).

English Summary.

The influence of irradiation dose of gamma rays on the radiosensitivity of six alfalfa varieties, among them Pleven I, Du Puits, Ranger, Vernal, and Neugaterslebener belonging to Medicago sativa L. and Kubanskaja Zheltaja belonging to Medicago falcata L, was studied. Air-dried seeds were irradiated with doses of 50, 80, and 100 krad. The following conclusions were made: (1) The alfalfa varieties studied differ in their radiosensitivity toward gamma rays. The critical dose (LD_{50}, after Gustafsson, 1957) for Neugaterslebener was about 50 krad; that for the varieties Ranger, Vernal, and Du Puits about 80 krad, and that for the variety Pleven I between 80 and 100 krad. The critical dose for the variety Kubanskaja Zheltaja (M. falcata) was beyond the highest irradiation dose (100 krad) tested in this study. (2) A consistent negative correlation between the frequency of chromosome aberration and the field germinating ability, survival and seed formation was found to exist within the individual varieties. (3) The gamma rays do not exert any essential influence on the frequency of self-incompatible forms which are useful for breeding. The irradiation doses of 50 and 100 krad increase the frequency of the male-sterile plants in the variety Pleven I. (auth)

14323 MUTATION BREEDING OF WHEAT. Hanis, M. (Hlavni Specializovana Slechtitelska Stanice, Stupice (Czechoslovakia)). Genet. Slechteni; 9: No. 4, 253-260(Oct 1973). (In Czech).

The effect of x radiation, gamma radiation, and EMS on mutation frequency in seven varieties of winter wheat was studied. In generation M_2, 0.01 to 0.16% of mutants showed resistance to mildew, 0.1% showed resistance to stripe rust, and 0.005% showed resistance to leaf rust. An improved quality of grain was observed in 0.03% of mutations, and an improved yield of grain was found in 0.004 to 0.0079% of mutations. Also observed were various morphological mutations. All useful mutations were found to show pleiotropic effects or were accompanied by deleterious mutations. (auth)

14324 MUTATION BREEDING OF ALSTROEMERIA. Broertjes, C. (Association Euratom-ITAL, Wageningen (Netherlands)); Verboom, H. (B. V. Handels-Kwerkerij M. C. van Staaveren, Aalsmeer (Netherlands). Research Department). Euphytica; 23: No. 1, 39-44(Feb 1974).

Actively growing young rhizomes of various Alstroemeria cultivars, most sterile hybrids, were treated with x rays. The optimum dose was about 400 rad for diploid cultivars and 500 to 600 rad for triploid ones. Although the buds on the rhizomes have multicellular apices, no x ray mutant showed any sign of chimerism. Among the large number of mutants, several proved to be improvements and have been released to the trade. (INIS)

14325 INFLUENCE OF WATER CONTENT ON THE SENSITIVITY OF RICE SEEDLINGS TO ^{60}Co GAMMA RADIATIONS. Bayonove, J.; Soler, A.; Jonard, R. (Univ., Montpellier, France). Compt. Rend., Ser. D; 278: No. 19, 2481-2484(6 May 1974). (In French).

The radiosensitivity of rice seedlings (Oryza sativa L.) of the Cigalon variety diminishes when their water content increases between 8.0 and 16.8%. This reduction in radiosensitivity is particularly marked for water levels in the 10.6 to 13.2% bracket and this is so for all radiation doses. The water content giving the seedlings maximum resistance to the effects of radiation increases with the exposure doses. (FR)

14326 THE GAMMA-RAY EFFECT ON THE GROWTH, PRODUCTIVITY AND SOME BIOCHEMICAL CHANGES OF PEPPER. Izvorska, N. Izv. Inst. Fiziol. Rast., Bulg. Akad. Nauk.; 18: 79-86(1973). (In Bulgarian).

Seeds from the pepper variety Djulunska brier are irradiated with different doses of gamma rays. The plant's phenological development, obtained by the irradiated seeds, the total yield from the fruit, and some biochemical changes are deduced. The stimulating effect of the doses from 500 and 1000 R gamma-rays is reported with respect to the development, mass blossom-

ing, and final yield. The irradiation with gamma rays produces a decrease in the content of alkaloid capsaicin. This content is lowest at the dose of 5000 R. An increased content of vitamin C is reported in the fruit irradiated with 5000 R gamma rays. (auth)

14327 MODIFYING EFFECT OF GIBBERELLIN AND ETHYLENE IMINE AFTER IRRADIATION OF SEEDS OF VICIA FABA WITH GAMMA RAYS. Dryanovska, O. A.; Tkhuan, N. T. (Bylgarska Akademiya na Naukite, Sofia). Compt. Rend. Acad. Bulg. Sci.; 26: No. 8, 1089-1091(1973).

The action of ethylene imine as a mutagenic factor was compared with that of gibberellin as growth regulator in their combined utilization with gamma rays in Vicia faba. Immediately after irradiation of the seeds with 5 or 10 kR gamma rays, they were treated for 8 hours with ethyleneimine (0.005%) or gibberellin (0.00001 m%). Preparations were made from the roots when 15 to 20 mm long and cytogenetical analysis done of metaphases. Compared with the controls, ethyleneimine has a marked mutagenic effect; gibberellin shows a very slightly expressed mutagenic effect. The effect of the combined action of the radiation with ethyleneimine is less manifest, compared with the effect of radiation alone, but it is stronger than in the case of processing with ethyleneimine only. The same is valid for gibberellin also. The modifying effect of gibberellin and ethyleneimine in regard to the aberrations is differently manifested in the two doses. Attempts for explaining the action of the two compounds studied of the genetic structures in combination with the radiation is done. (INIS)

14328 INFLUENCE OF TEMPERATURE SHOCKS ON SEED FORMATION AFTER IRRADIATION OF POLLEN FROM TRADESCANTIA PALUDOSA. Dryanovska, O. A. (Bylgarska Akademiya na Naukite, Sofia). Compt. Rend. Acad. Bulg. Sci.; 25: No. 5, 680-683(1972).

The aim of the study was to follow the effect of low temperature after irradiation of pollen from diploid and tetraploid clones of Tradescantia paludosa, on the formation of capsules and seeds. Irradiation of dry pollen was carried out with 1 to 50 kR gamma rays (dose rate 2 kR/minute). After irradiation some of the pollen was placed at 0°C for 1 to 34 days, while other part was used to pollinate the flowers immediately in the greenhouse at 20 to 25°C. The following principal conclusions can be drawn from the studies: Gamma irradiation can overcome the incrossability between the diploid clone 6-50 and the tetraploid clone 131 (in doses of 1 and 5 kR); Temperature shocks have a restorative effect on haploid and diploid pollen at the higher doses as well (5 to 50 kR); Temperature shocks are able to increase fertility and to overcome the incrossability between 6-50 and 131 at dose of 10 and 50 kR. (INIS)

14329 MODIFICATION OF THE GAMMA-IRRADIATION EFFECT ON AIR-DRIED RADISH SEEDS BY MEANS OF HEAT SHOCKS. Nikolov, Ch. Genet. Selek.; 6: No. 6, 431-438(1973). (In Bulgarian).

Air-dried seeds of radish were treated with 80°C heat shocks of different duration before, after, before and after gamma-irradiation of 30, 60, 90, 120, 150, and 180 krad, and a dose rate of 780 rad/min. The total plant length (root + stem) was measured at the 7th day following emergence of plants. The duration of the heat shock most suitable for modifying the radiobiological reactions of this object was found to be 60 minutes. The results of threefold experiment series revealed a decrease of the depression effect from irradiation in the case of 80°C 60 min heat shock applied before, before and after irradiation within the range of 90 to 120 krad. The same heat shock applied after irradiation increased the depression effect from irradiation within the range of the doses applied. (auth)

14330 STUDY ON THE EFFECT OF FAST NEUTRON IRRADIATION AND ETHYLMETHANESULFONATE TREATMENT OF BEAN SEEDS. Ilieva-Staneva, B. Genet. Selek.; 6: No. 6, 467-477(1973). (In Bulgarian).

The effect of fast-neutron (FN) irradiation and ethyl methanesulfonate treatment (EMS) of air-dried seeds of Phaseolus vulgaris L. (Savi), var. subcompressus, was studied. The FN-irradiation was carried out with a dose rate of $\pm 1.10^8$ F/cm^2/sec, at focal distance of 120 cm and doses from 175 to 1575 rad, the difference between treatment doses being 175 rad. The EMS-treatment was effected at 20°C with four concentrations: a) 0.6 and 0.3 per cent concentrations of EMS for 6 h; b) 0.15 and 0.075 per cent concentrations of EMS for 24 h. A much weaker depressing effect on the M_1 is produced with fast neutrons at the exposures applied than with EMS-treatment. The strongest damage effect, which is expressed in lower numbers of emerged, surviving and fertile plants, is observed with the 0.6% concentration of EMS for 6 h followed by the 0.15% concentration for 24 h. The treatment with 0.3% and 0.075% concentrations EMS for 6 respectively 24 h have a weaker effect. The mutation frequency is higher with the EMS-treatment than with the FN-irradiation, in the first case the frequency of the chlorophyll mutations being higher than that of the morphological mutations. The FN-induced mutations are predominantly with yellow-green leaves and of morphological type. In general, a rather narrow spectrum is observed with both mutagens. Mutants with individual or a complex of valuable economic characters are obtained. Some of them are markedly yielding more than the initial variety. (auth)

14331 EFFECT OF LOW RADIATION DOSES ON THE GROWTH, DEVELOPMENT AND YIELD OF MAIZE. Todorov, G. Rast. Nauki; 10: No. 5, 3-11(1973). (In Bulgarian).

Seeds of the double cross maize hybrides WIR-42, Wisconsin 641 AA and Kansas 1859 were treated with gamma rays in doses of 500, 1000, 1500, 2000, and 2500 R. It was established: (1) It is necessary to use very uniform seed material regarding its genetic purity, physical and physiological properties, and chemical composition. (2) Doses in the range of 500 to 2500 R had in individual years a clearly expressed stimulative effect on the yield and on some concomitant characteristics. This effect, however, in many cases is quite variable. (3) Regarding the total vegetative mass the stimulative effect was more slightly expressed. (auth)

14332 SEGREGATION PATTERN IN THE M3 GENERATION OF RICE (ORYZA SATIVA L.) ORIGINATING AFTER SINGLE AND PREIRRADIATION TREATMENT WITH DISTILLED WATER. Bose, S.; Gose, M. (Calcutta Univ. (India). Agricultural Coll.). Indian J. Agr. Res.; 6: No. 1, 55-57(1972).

An attempt was made to study the segregation pattern of some mutants obtained in the M_3 generation of rice (Oryza sativa L.). The M_1 generation originated after (i) single treatment with distilled water (DW) and diethyl sulphate (DES) for 24 hr and (ii) pre- and (iii) post-irradiation treatment with DW and DES for the same length of time. (auth)

14333 EFFECT OF GAMMA-RAYS ON SEEDS AND SEEDLINGS OF CERTAIN VINE CULTIVARS. Bozhinova-Boneva, I.; Kondarev, M. Gradinar. Lozar. Nauka; 10: No. 6, 115-124(1973). (In Bulgarian).

The test was conducted with seeds produced from free blossoming of 8 cultivars and 2 hybrids. The seeds were first stratified and then irradiated at 4, 6, 10, 20, 30, and 40 kR. Eight hundred seeds per dose were treated. Green cuttings were also treated at 0.5, 1, 2, 4, 6, and 8 kR. After the treatment, the buds were grafted on Monticola stocks. Doses in excess of 10 kR proved lethal for the stratified seeds. Optimal irradiation rates for the seeds proved 4 and 8 kR, and 2 kR for the green shoots. The leading apex failed to develop with the 4 and 6 kR doses. With 8 kR no callus was formed and consequently there was no taking hold. (auth)

14334 EFFECTS OF IONIZING RADIATION ON ROSES WITH REFERENCE TO INDUCTION OF MUTATIONS. CSIR (Counc. Sci. Ind. Res.) News; 24: No. 6, 43-44(30 Mar 1974).

The effect of acute gamma irradiation on seven rose cultivars was studied. The results obtained in the case of different specimens were compared and discussed. It was concluded that the induction, isolation, and multiplication of mutants in rose cultivars Pink Parfait and Quebec amply prove that gamma irradiation can be a very useful tool for plant improvement. (INIS)

14335 SOME ANATOMICAL FEATURES OF A RADIATION-INDUCED GRAPE VARIEGATA. Sharma, R. L.; Mukherjee, S. K. (Indian Agricultural Research Inst., New Delhi. Div. of Horticulture). Vitis; 12: No. 3, 189-191(Oct 1973).

1 tab.; 7 refs. Part of thesis by Sharma, R. L.

Some anatomical and a few distinguishing morphological features of radiation-induced Pusa Seedless variegata are described. The chlorophyll deficient sectors, which were identical on the two surfaces of the leaves, were usually thinner than the green sectors and thinness was either due to the reduced number of mesophyll layers or smaller cells or both. The yellow colouration of chlorotic sectors seemed to be mainly due to thinness of the sectors and to some extent due to lack of sufficient chlorophyll. (auth)

14336 EFFECT OF GAMMA-RAYS ON CUT BLOOMS OF PROTEA COMPACTA R. BR., P. LONGIFLORA LAMARCK AND LEUCOSPERMUM CORDIFOLIUM SALISB. EX KNIGHT. Haasbroek, F. J.; Rousseau, G. G.; de Villiers, J. F. (Fruit and Food Technology Research Inst., Stellenbosch (South Africa)). Agroplantae; 5: 33-42(1973).

Summary in Afrikaans and French. 4 refs.

The effects of gamma rays combined with two storage and

two post-storage treatments were studied on cut blooms of Protea compacta R. Br., P. longiflora Lamarck and Leucospermum cordifolium Salisb. ex Knight. Irradiation suppressed both the rate and degree of opening of the Protea blooms but did not affect the Leucospermum blooms. No adverse effects of irradiation on the blooms were detected except at a dose of 90 kR in one of the treatment combinations. However, irradiation enhanced the blackening of the foliage of P. compacta and P. longiflora, but this could be effectively counteracted by using a preservative solution. This solution also markedly increased the vase-life of the blooms. (INIS)

14337 STUDY OF COMPLEX EFFECT OF IONIZING RADIATION AND ETHYLENIMINE ON GERMINATING SEEDS OF CREPIS CAPILLARIS. Sidorov, V. P.; Makedonov, G. P. (Research Inst. for Biological Testing of Chemicals, Moscow). Genetika; 10: No. 11, 44-48(Nov 1974). (In Russian).

An effect of postirradiational treatment by ethylenimine was not over of additional level in diploid cells. However, irradiation of seeds, pretreated by ethylenimine, increased the frequency of aberrations both chromosomal and chromatid types as compared with separate effect of the mutagens. (auth)

Radiation Effects on Animals

14338 (CEA-CONF-2827) ANALYSIS OF RADIATION INDUCED CHROMOSOME ABERRATIONS. Brenot, J. M.; Parmentier, N. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). [nd]. 22p. (CONF-740715-21). Dep. NTIS (US Sales Only) $4.25.

From 5th international radiation research congress meeting; Seattle, Washington, USA (14 Jul 1974).

Recent developments, such as chromosome banding techniques, promise a more detailed understanding of the radiation induction of chromosome aberrations. The biophysical basis of chromosome damage produced by different types of ionizing radiation is reviewed and the statistical procedures applied to the analysis of dose-effect relations are discussed. The experimentally observed linear-quadratic dose dependences are interpreted in terms of microdosimetry, and the derivation of site diameters or interaction distances is discussed. It is pointed out that a rigorous treatment of radiation quality must be accompanied by an accurate statistical analysis of the observed dose-effect relations. The least-squares method is applied to the linear-quadratic model; the least-squares criterion, the fit and the determination of joint confidence region of the estimated parameters are discussed. (CH)

Man

Refer also to abstracts 13696, 13770, 14106, 14270, 14284, 14407, 14438, and 15801-15805.

14339 (ABCC-TR-0-72) BIBLIOGRAPHY OF PUBLISHED PAPERS OF THE ATOMIC BOMB CASUALTY COMMISSION. (Atomic Bomb Casualty Commission, Hiroshima (Japan); Atomic Bomb Casualty Commission, Nagasaki (Japan)). 1972. 11p. Dep. NTIS (US Sales Only) $4.00.

The bibliography includes those papers published by the commission during 1972. Fifty-nine citations are included. (ERB)

14340 (BNL-19290) CONCEPT OF HUMAN STEM CELL KINETICS. Cronkite, E. P. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 19p. (CONF-740715-19). Dep. NTIS $4.00.

From 5th international radiation research congress meeting; Seattle, Washington, USA (14 Jul 1974).

Techniques applicable to studies of the radiosensitivity of human hematopoietic stem cells are reviewed. Results of studies in experimental animals and studies using cultured human bone marrow cells are reported. (CH)

14341 (CEA-N-1728) HEALTH PHYSICS AGAINST RADIOLOGICAL DAMAGE. Remond, A. (CEA Centre d'Etudes de Vaujours, 93 - Sevran (France)). 12 Apr 1973. 59p. (In French). Dep. NTIS (US Sales Only) $6.00.

This work, intended for the uninitiated in the field of radiation protection, describes in non-mathematical or technical terms the means employed to reduce radiological risks. The origins of ionizing radiations and their effects on man, units, and safety norms used in health physics, detection of ionizing radiations and shielding possibilities are reported. Special emphasis is laid on the obligatory medical supervision of personnel working in ionizing surroundings. Details on natural radioactivity and on nuclear industry development prospects in France are given in appendices. (FR)

14342 (CONF-740115-, pp 72-78) CAPABILITIES FOR CONTROL OF PLUTONIUM IN PROCESSING. Valentine, A. M. (Los Alamos Scientific Lab., NM). Dec 1974.

From plutonium information meeting; Los Alamos, New Mexico, USA (4 Jan 1974).

In plutonium information meeting.

Experience in handling Pu on an industrial scale during the past 30 years is reviewed. Methods developed that control releases to the environment to microgram quantities, prevent workers from being exposed to penetrating radiation levels, and prevent significant Pu intake by workers are described. Data are reviewed on the typical Pu isotopic compositions of weapons-grade Pu, low-exposure fast reactor fuel elements (FFTF), high exposure breeder reactor fuel elements (LMFBR), and ^{238}Pu heat sources; the decay scheme and half-life of ^{236}Pu, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Pu, ^{242}Pu, ^{241}Am, and ^{237}U; the energy and yield of x and γ rays from ^{236}Pu, ^{238}Pu, ^{239}Pu, ^{240}Pu, and ^{241}Pu; the neutron yields and specific activity for selected Pu types; and the maximum permissible body burden, concentration in air, and concentration in water of ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Pu, and ^{242}Pu. The design features of a number of Pu processing plants are described briefly. It is pointed out that new Pu processing plants are being designed not only to provide for the protection of personnel in the plant and for the treatment of effluents released to the environment but to protect against disasters such as earthquakes and tornadoes. It is pointed out that the protection of Pu workers depends primarily on the amount of material present, the isotopic content, and the time since it was purified or separated in its physical or chemical state. Weapons-grade Pu workers receive a neutron dose of from 0.5 to 1 rem/yr, but the neutron emission rate from LMFBR fuel elements will result in a neutron dose rate about 10 times higher. The design features of two hydrogenous shielded glove boxes for handling significant quantities of ^{238}Pu are described. The use of shielding for protection of workers against γ and neutron exposure, advances in monitoring Pu in air and the measurement of internal deposition, and methods for prevention of traumatic injuries to personnel are discussed briefly. Methods for the treatment of gaseous, liquid, and solid wastes to prevent contamination of the environment are outlined. (CH)

14343 (CONF-741034-3) SPLIT-COURSE VERSUS CONTINUOUS IRRADIATION OF CANCER. Marcial, V. A. (Puerto Rico Nuclear Center, Mayaguez). 1974. 10p. Dep. NTIS $4.00.

From 11th international cancer congress; Florence, Italy (20 Oct 1974).

Split-course radiotherapy consists of the introduction of one or more rest periods in the plan (or course) of treatment with fractionated irradiation. This form of radiotherapy constitutes the preferred modality for advanced carcinomas of the head and neck seen at the Puerto Rico Nuclear Center, and in the radiation therapy program of the University of Puerto Rico School of Medicine. The potential merits of this technique are summarized. (CH)

14344 (CONF-741219-1) FUTURE OF PERSONNEL MONITORING IN AREAS WITH HOT AND HUMID CLIMATES. Becker, K. (Oak Ridge National Lab., Tenn. (USA)). 1974. 13p. Dep. NTIS $4.00.

From first Asian regional congress on radiation protection; Bombay, India (15 Dec 1974).

With the increasing use of radiation sources in tropical countries, the selection of optimum systems for personnel monitoring is becoming a matter of worldwide concern. The present status of personnel dosimetry, characterized by instable and inaccurate detectors and oversimplified interpretation of the results, leaves much to be desired. Photographic film, although having certain advantages with regard to economics and information content, undergoes rapid changes in hot and humid climates; careful sealing reduces, but does not prevent these problems. More promising is the replacement of film by solid-state dosimeters, primarily TLD. Such a change, which is either in progress or being considered by an increasing number of institutions, requires a number of decisions concerning the choice of the optimum detector(s), badge design and evaluation system; organizational matters, such as the desirability of automation and computerized bookkeeping; etc. It also implies the potential use of advanced concepts such as different detectors and monitoring periods for the large number of low-risk persons, and the small percentage of high-risk radiation workers. (auth)

14345 (INIS-mf-930) RADIOISOTOPES IN THE SERVICE OF ENVIRONMENTAL PROTECTION. Ljunggren, K. (Isotoptekniska Laboratoriet, Stockholm (Sweden)). 1973. 29p. (In Swedish). INIS.

The use of isotope techniques in environmental protection is reviewed. A number of applications of tracer techniques in connection with industrial effluents as well as for measurement of contamination of groundwater from sewage leaks and waste dumps are mentioned. A method for the measurement of oxygenation of water by atmospheric oxygen, using tritium and ^{85}Kr is described. Mercury, DDT and SO_2 pollution studies are also mentioned. While the role of activation analysis is primarily illustrated by the mercury investigations performed in Sweden, other metallic pollutants may also be measured. Activation analysis of inactive tracers is discussed, as are x-ray fluorescence analysis and radio-release. Finally radiometric instruments and radiation processing technology are briefly treated. (INIS)

14346 (INS-R-117) HAZARDS OF NUCLEAR TESTING IN THE ATMOSPHERE. Whitehead, N. E. (Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Physics and Engineering Lab.). Feb 1973. 8p. INIS.

A review (without references) of the effects of radiation on man is presented, including the effects of fallout. It is calculated that the dose to man from fallout deposited in New Zealand is approximately 2% of natural background. Man receives a greater dose of cosmic rays with height. It is estimated that (for New Zealand) living at 150 feet above sea level instead of at sea level will give an increased dose equivalent to the radiation received from total fallout. It is estimated also, that living 10–15 ft above sea level instead of at sea level gives increased radiation equivalent to the fallout radiation dose from French nuclear tests alone. Total fallout, at most pessimistic estimate might cause one extra death from leukaemia in New Zealand in the next four years; French fallout might cause one death in the next fifty-six years. The average death rate from leukaemia in New Zealand per year is about 200. It is calculated the risk of death per person per year from total fallout in New Zealand is at most 1 in 45 million. The risk of being murdered, is only 1 in 90,000 by comparison. (auth)

14347 (NP-20146) WORKING WITH RADIATION. (British Nuclear Fuels Ltd., Risley). 1974. 32p. British Nuclear Fuels Ltd., Risley, Eng.

This small, popular, illustrated booklet has the section headings: the nature of radioactivity, natural and man-made radiation, biological effects of radiation, control and assessment of radiation exposure, precautions when dealing with radioactivity, criticality or nuclear safety, the growth of nuclear power. Appendices contain information relevant to radiation protection, e.g. radiation properties of some important radioisotopes, maximum permissible dose, maximum permissible concentration, maximum permissible level. (UK)

14348 BIOCHEMICAL INDICATORS. Gerber, G. B. (CEEN, Mol, Belg.). Rayonnements Ionis. Tech. Mes. Prot.; No. 2, 71-82(Apr 1974). (In French).

Biochemical indicators show up radioinduced metabolic changes. However they are not considered as dosimeters in the strict sense since they do not necessarily correspond to physical doses, but rather as informers on the sequence of events taking place between the physical process of absorption and the appearance of biological symptoms. It is emphasized that biochemical indicators are only of potential value in cases of accidental or therapeutic exposure, but cannot be used for professional exposures at low radiation doses. The various characteristics of biochemical indicators, the criteria they have to meet and their field of application are reviewed. Those of true potential value are examined and classified according to their chemical and metabolic properties rather than to their action mechanisms, which are often little understood. (FR)

14349 ^{75}Se-METHIONINE TEST, CLINICAL AND EXPERIMENTAL. Dimitrov, L. A. (Nauchno-Izsledovatelski Inst. po Khematologiya i Kryvoprelivane, Sofia (Bulgaria)). Compt. Rend. Acad. Bulg. Sci.; 27: No. 2, 291-294(1974).

Clinical tests were made on 16 normal persons and 33 patients (10 oncologically irradiated and 23 hematologically). The experimental investigations on hemopoiesis injured by means of ionization were made on 84 controls and 190 test white rats, irradiated with 400 and 800 R doses. ^{75}Se-methionine was applied intravenously in men in doses of 2 to 2.5 μCi/i.p. and in rats of 1.5 μCi/100 g i.p. In all cases the incorporation of this compound was traced in plasmatic proteins, erythrocytes, thrombocytes, and leucocytes, and their life spans were determined. The results were compared with those obtained by the routine methods with ^{59}Fe ascorbinate. The two methods give similar regularities, but selenium methionine also gives information on the state of the thrombopoiesis and leucopoiesis. In vitro control experiments revealed that ^{75}Se-methionine cannot label directly the mature blood elements. There are no reutilization symptoms in the first 30 days after ^{75}Se-methionine injection. The test can be successfully applied in the diagnosis and forecasting of hypo- and aplastic states, chronic leukemias, in x-ray therapy and other states. (INIS)

14350 CYTOGENETIC RESEARCH IN GREAT BRITAIN. Lloyd, D. C.; Purrott, R. J.; Dolphin, G. W. (National Radiological Protection Board, Harwell, Eng.). Rayonnements Ionis. Tech. Mes. Prot.; No. 3, 135-144(Jul 1974). (In French).

Chromosomic analysis of the peripheral blood lymphocytes is considered very useful for the study of workers exposed to radiation and patients undergoing radiotherapy. It would even be an ideal method of studying damage due to the use of new particles for radiotherapeutic purposes. A survey of the experimental studies at the origin of biological dosimetry is followed by a review of the application of chromosomic research in radioprotection and radiotherapy. The different cases encountered in radioprotection are divided arbitrarily into 4 categories for the sake of simplification: non-homogeneous exposure risk; known over exposure; presumed over-exposure in persons not carrying a dosimeter; chronic external or internal exposure. In radiotherapy, after pointing out that treatment often leads to high doses and that cytogenetic supervision has here proved very instructive, examples are given of the treatment of articular rheumatism by radioactive gold or yttrium, and long-term treatment of thyroid cancers by radioactive iodine. (FR)

14351 RADIOPROTECTION AT THE EUROPEAN LEVEL. Recht, P. (EURATOM, Brussels). pp 49-57 of Radioprotection Regulations. Montrouge, France; Societe Francaise de Radioprotection (1973). (In French).

From meeting on radioprotection regulations; Paris, France (18 Jun 1973).

In 1959 a common health policy concerning the dangers of radioactivity led to the creation of fundamental norms and derived radioprotection norms. Experience has shown that a general revision of these norms is necessary. The reviewed version is in preparation and follows more closely the recommendations of IRPC Publication 9 except on points of detail where attempts are being made to interpret clauses that hitherto were expressed in deliberately over-cautious terms. Examples are given concerning, in particular, acceptable dose limits, exposure of workers (monitored zone, controlled zone), medical inspection of workers, delegation of responsibilities, and a recently introduced item on supervision of populations. Radioprotection and its concepts must also be adapted to environmental obligations, article 37 of the Euratom treaty concerning effluent discharge being a case in point. This article has proved to be exceedingly important and already enters into the prospect of the general environment policy. It is emphasized that radioprotection policy must pronounce clearly and objectively on the dangers of radioactivity. (FR)

14352 CONSIDERATIONS ON THE RADIATION LOADING OF PATIENTS DURING PNEUMOGYNECOGRAPHY. Dyankov, L.; Penchev, V. (Institut za Spetsializatsiya i Usyvyrshenstvuvane na Lekarite (ISUL), Sofia (Bulgaria)). Rentgenol. Radiol.; 11: No. 4, 239-244(1972). (In Bulgarian).

Measurements were performed of the surface and gonadal exposure in plain and in narrow-diaphragm subscreen pneumogynecography using homogeneous tissue-equivalent phantom under conditions simulating those of the examination. Plain pneumogynecography yielded the following results: with normal X-ray technique gonadal exposure at a depth of 6 cm was 428 mR, with hard technique 327 mR and in working with exposure automatic apparatus - 37 mR. Radiation loading was much milder in narrow diaphragm subscreen films. The decrease in ovarial exposure in these cases varied from 32.1 to 46.8 per cent. The intensity of gonadal exposure in pneumogynecoscopy (screen field of 18 × 24 cm^2) varied from 280 to 92 mR/min. It is recommended to use exposure automatic apparatus, hard X-ray technique and narrow-diaphragm subscreen pneumogynecoscopy. (auth)

14353 GENETIC STUDIES IN CHILDREN UNDERGOING ROENTGEN-DIAGNOSTIC PROCEDURES OF THE HEART. Ivanov, B. A.; Dermendzhiev, Kh. T.; Iliev, D. (Nauchno-Izsledovatelski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Rentgenol. Radiol.; 11: No. 4, 221-225 (1972). (In Bulgarian).

Four children were examined for genetic changes in peripheral blood lymphocytes before and after roentgen studies for cardiovascular disease. Only one child had one per cent spontaneous chromosomal aberrations, chromatid deletion. Chromosomal studies instituted after roentgen-diagnostic procedures (cardiac catheterization) revealed chromosomal aberrations on the lymphocyte metaphasic lamellae in all four children. Two children had predominantly one-stock chromosomal aber-

rations, chromatid and chromosomal fragments. The other two children, in addition to the one-stock chromosomal aberrations, had two-stock ones in the form of dicentrics. In one child the dicentrics were 0.33 per cent, in the other, 0.66 per cent. The chromatid fragments in all children varied from 2 or 2.5 to 3 per cent, and the chromosomal, 1 per cent. The structural chromosomal changes in the peripheral blood lymphocytes of children exposed to large x-ray doses during diagnostic procedures correlate with data of other authors. (auth)

14354 INTEGRAL AND SKIN DOSES RECEIVED BY THE POPULATION DURING ROENTGENOSCOPIC AND ROENTGENOGRAPHIC EXAMINATION OF THE LUNGS. Khadzhidekov, G.; Penchev, V.; Maleev, N. (Institut za Spetsializatsiya i Usyvyrshenstvuvane na Lekarite (ISUL), Sofia (Bulgaria)). Rentgenol. Radiol.; 11: No. 2, 69-73(1972). (In Bulgarian).

Inquiries were made on the number of x-ray examinations of the lungs in Bulgaria in 1968. Measurements were made on 28 roentgendiagnostic sets for determining the mean integral and skin dose received by patients during pulmonary roentgenoscopy and roentgenography. These data served to evaluate radiation loading of the population and to give suggestions for its decrease. (auth)

14355 IONIZING RADIATION AND THEIR INFLUENCE ON SEX GLANDS, PREGNANCY AND FETUS. Marinova, G. Akush. Ginekol.; 12: No. 3, 200-215(1973). (In Bulgarian).

The influence of ionizing radiation on the female sex organs was studied in 223 women physicians, technicians, and attendants working in x-ray rooms. The following menstrual disorders were recorded: oligomenorrhea in 19.7 per cent, hypermenorrhea in 17.5 per cent, dysmenorrhea in 16.1 per cent and secondary amenorrhea in 4.4 per cent. Of 15 women with menstrual disorders 5 had anovular cycles, 10 had decreased estrogen saturation, 9 had reduced pregnandiol values and 10 had reduced 17-ketosteroid values. Of 438 pregnancies 12 terminated with premature delivery and 49 with spontaneous abortion. (INIS)

14356 PROCESS OF RADIATION INJURY AND ITS COUNTERMEASURES. Soeda, S.; Bando, M. (Tokyo Univ.). Saigai Igaku; 17: No. 4, 261-268(Apr 1974). (In Japanese).

The injuries to skin by radiotherapy for hemangioma or malignant tumor were divided into acute and chronic conditions, and these conditions and malignant changes after the irradiation are described in relation to the irradiation doses. As for the treatment of chronic radiation dermatitis, surgery is usually carried out. In general, the treatments of superficial radiation dermatitis were successful because of easy grafting of skin. In deep dermatitis, the success of skin grafting was influenced by softness and bleeding conditions of the base and it was observed that dermatitis in the softer base was satisfactorily treated. When the reconstruction of filthy ulcers was started by flap, the results were rather satisfactory. (JA)

14357 ENVIRONMENTAL GAMMA MONITORING USING THERMOLUMINESCENT DOSIMETERS AND AN AUTOMATIC DATA MANAGEMENT SYSTEM. Fitzsimmons, C. K.; Whitesell, J. T.; Wruble, D. T. (Environmental Protection Agency, Las Vegas, NV). pp 119-135 of Environmental Surveillance Around Nuclear Installations. Vol. II. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol.2); CONF-731117-(P2).

A network of about 100 stations within a 300 km radius of the USA's Nevada Test Site provides continuous monitoring for gamma radiation by use of CaF_2: Mn thermoluminescent dosimeters (TLDs). Residents of this off-site area are also monitored with TLDs. An automatic data processing system using a CDC 6400 computer statistically estimates ambient background levels and calculates exposures which may be greater than background. Exposure histories of all stations and individuals are stored on disk files which are updated each month. Dosimetry reports are generated monthly and special reports of past exposures for specific stations or for stations within prescribed geographical areas can be generated through interrogation of the files. The system includes tables of TLD correction factors, background exposure rates, and values for an F-test and Duncan Multiple Range test. Data can be accepted from any gamma dosimeter or from calculated exposures derived from rate meter measurements via a single card record format. Objectives of the dosimetry network are to provide continuous surveillance of the off-site area for releases of radioactivity, to provide a base of background data on which to compare low level exposures, and to document the magnitude of environmental exposures from either planned or unplanned radioactivity. Personal contact with residents wearing TLDs also provides a valuable community relations program. The automatic data processing system was designed to increase the information output of the dosimetry programme while reducing the workload of calculations and record keeping. The system provides rapid access to historical data whose validity is assured by data check programmes and the provision for human judgement. The dosimeters are individually calibrated with ^{137}Cs γ radiation. The overall calibration accuracy is about ±10% with a minimum detection of about 5 mR over a month's background. Energy response varies within ±14% of the mean response from 70 keV to 1250 keV. (auth)

Vertebrates

Refer also to abstracts 14221, 14265, and 14285.

14358 (BNL-19495) STUDY OF LYMPHOCYTOPOIESIS BY LYMPHOCYTE DEPLETION. Conkite, E. P. (Brookhaven National Lab., Upton, N. Y. (USA); State Univ. of New York, Stony Brook (USA)). 1974. 48p. (CONF-741105-51). Dep. NTIS $5.50.

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

Data are reviewed from studies on the relationship of lymphocyte populations and immunity in mammals. The generative cycle of lymphocytes, factors influencing the rate of lymphocyte proliferation, the role of immune reactions in the rejection of tissue and organ grafts, and the influence of extracorporeal irradiation of blood and lymph on the rate of lymphopoiesis are discussed. (CH)

14359 (COO-3521-128) BIOLOGICAL EFFECTS OF RADIATION, AND RELATED BIOCHEMICAL AND PHYSICAL STUDIES. Summary Progress Report, July 1, 1950-September 30, 1971. Wade, L. (Sloan-Kettering Inst. for Cancer Research, New York (USA)). 30 Sep 1971. Contract AT(30-1)-910. 273p. Dep. NTIS $16.75.

Brief summaries are presented of research studies over a 21-year period. Emphasis was placed on the role of radioinduced free radicals in the induction of radiation injuries, the role of free radicals in carcinogenesis, and the evaluation of radioisotopes for organ scintiscanning. A list is included of over 500 publications during the period. (CH)

14360 (IAEA-R-916-F) IDENTIFICATION OF THE RADIOSENSITIVE STAGES DURING THE DIFFERENTIATION OF THE IMMUNOCOMPETENT CELL. Final Report, 1 June 1970-30 June 1973. Sterzl, J. (International Atomic Energy Agency, Vienna (Austria)). Jul 1973. 13p. INIS.

Radiosensitivity of immunocompetent cells at various stages of differentiation was examined together with the analysis of conditions required for the restoration of immunological functions of lethally irradiated animals using conventional or germ-free mice, rabbits, and piglets. Immune capacity of the liver and lymphatic cells of mice embryos was found to be one hundredth of that from adult mice. The competence develops first in the liver, shifting after the birth into the intestinal lymphatics and then the spleen. The switching of production of IgM to that of IgG was proved to occur in the dividing precursor cells of B line in the colonies of antibody forming cells. A period was found to exist after immunization, in which sublethal irradiation does not depress IgM production but inhibits the appearance of IgC suggesting the functioning of gene switch during this period. Immunocompetent cells start proliferation within 24 hours after the administration of antigen, from the pool of which antibody forming cells are recruited later. Germ-free piglets irradiated with supralethal dose showed a three fold increase in survival time compared with controls. Damages in the intestinal mucosa, penetration of E.coli, enhanced sensitivity to endotoxin, and a temporary depression in complement levels were considered to be mainly responsible for the radiosensitivity of animals associated with microbes. (INIS)

14361 (INIS-mf-1488) RESPONSES OF A RAT RHABDYMYOSARCOMA AND RAT SKIN TO IRRADIATION WITH GAMMA RAYS AND 15 MeV NEUTRONS AT LOW DOSE RATES. Kal, H. B. (Gezondheidsorganisatie TNO, Rijswijk (Netherlands). Radiobiologisch Instituut TNO). 28 Mar 1974. 124p. INIS.

Factors were studied that influence cell survival in tumors and normal tissues during and after irradiation with gamma radiation and with 15-MeV neutrons at a low dose rate. The irradiation effectiveness was determined on a transplantable rhabdomyosarcoma and on the skin of the WAG/Rij rat. Repair of sublethal damage occurred during continuous gamma irradiation in vitro at low dose rates. During in vivo irradiation, this process is counterbalanced one to increased radiosensitivity following reoxygenation of the tumour. In tumours the effectiveness for damage is 1.45 smaller for chronic than for acute

irradiation in the case of gamma irradiation. For 15-MeV neutrons this factor is 1.1. The RBE of 15-MeV neutrons at 48 rad/h for the rhabdomyosarcoma is about 4.3 relative to ^{137}Cs gamma rays. The RBE of 15-MeV neutrons at 48 rad/h for damage to rat skin relative to ^{137}Cs gamma rays is about 2.7 at the 10% level. The therapeutic gain factor is 1.6 which is higher than the gain factor for acute irradiation, which lies between 1.1 and 1.3. These results suggest that the use of ^{252}Cf neutrons at low doses might be of advantage in radiotherapy. The use of multiple dose fractions, separated by a few hours as an alternative for continuous irradiation is discussed. (INIS)

14362 (LA-5813-MS) INVESTIGATION OF THE TWO-COMPONENT RADIATION INJURY CONCEPT USING EQUIVALENT RESIDUAL DOSE FACTORS. Spalding, J. F.; Johnson, O. S.; Tietjen, G. L. (Los Alamos Scientific Lab., N. Mex. (USA)). Dec 1974. Contract W-7405-eng-36. 7p. Dep. NTIS $4.00.

An investigation of the two-component concept of γ radiation injury assuming a 7-day injury repair half-time (RT_{50}) and 5% long-term injury was carried out with mice. The results suggest that this concept is useful only under a limited range of exposure conditions. In this study, the incidence of neoplasia (primarily thymomas) appeared to be dependent on the radiation regime used, with possible therapeutic effects changing the death patterns in the largest dose group. No progressive bone-marrow lesion was seen with the dose levels used and, in this sense, the recovery rate was not affected by radiation history. This and other investigations suggest that, if the effects of a wide range of total exposures and dose rates are to be anticipated, equivalent residual dose (ERD) factors in the two-component concept of radiation injury recommended for man in emergency conditions should be modified downward. (auth)

14363 (UCSF-10P2-246) MODIFICATION OF RADIATION INJURY TO NORMAL TISSUES BY CHEMOTHERAPEUTIC AGENTS. Phillips, T. L.; Wharam, M. D.; Margolis, L. W. (California Univ., San Francisco (USA)). 1974. 25p. (CONF-731099-1). Dep. NTIS $4.25.

From 16th annual meeting of the American Society of Therapeutic Radiologists; Key Biscayne, Florida, USA (30 Oct 1974).

The effects of several cancer chemotherapeutic agents on radiation damage to normal intestine, esophagus, and lung tissue were evaluated in LAF_1 mice using quantitative endpoints. Actinomycin D increased injury in all tissues tested. Adriamycin increased injury significantly more than any other agent in the intestine. BCNU did not increase injury significantly in any of the 3 critical tissues. Bleomycin increased injury in the esophagus but not in the lung or intestine. Cyclophosphamide increased injury only in the lung, where vincristine caused minimal injury and hydroxyurea none. Only prednisolone caused significant radioprotection when given at the time of radiation or at the time of expected death from pulmonary injury. (auth)

14364 ROLE OF UNSATURATED FATTY ACIDS IN RADIATION SICKNESS. Deby, C. (Univ., Liege). Eulep Newslett.; No. 6, 53-74(6 May 1974).

From training meeting of the committee for Laboratory Animals Standardization; Louvain, Belgium(13 May 1974).

The unsaturated fatty acids include the essential fatty acids (EFA), which are necessary for normal growth and cellular functions and cannot be synthetized by vertebrates. They are found in certain vegetable lipids among other non-essential unsaturated molecules. It is now well known that a general excess of unsaturated fatty acids can aggravate radiation injury whereas EFA, at an optimal level, play a curative role in this syndrome. Consequently, it is important to select the essential fatty acids rather than other non-essential unsaturated fatty molecules in the food reserved for irradiated animals. The purpose here, is to define the essential fatty acids, to describe briefly their role in general physiology, their modality of interference in the course of radiation sickness and their therapeutical limits in this syndrome. (BE)

14365 USE OF IONIZING RADIATION IN TRANSPLANTATION. van Bekkum, D. W. (Radiobiological Inst. TNO, Rijswijk, Netherlands). Transplant. Proc., Suppl.; 6: No. 4, 59-65(Dec 1974).

Irradiation is an effective agent for killing lymphocytes, and therefore it is also extremely effective in inhibiting the immunological reaction of the host against organ and tissue grafts. However, its prolonged application, locally or generally, entails the severe problem of damage to other cells, some of which is critical. Controlled immunosuppression can be administered better and more safely by drugs than by single doses of whole-body irradiation. Radiation has gained an established place in treating blood transfusions for the prevention of GvH and in a number of neurosurgical centers for pretreating nerve grafts. There remains much information to be collected on the usefulness of ECIB, but this will take time because of the complexity of the technique. If these clinical applications of ionizing radiation in the field of transplantation appear to be rather disappointing, this is perhaps more than compensated by the established and widespread use of ionizing radiation in experimental immunology, where it continues to contribute to our understanding of the processes that control the host's responses to foreign tissues. (auth)

14366 EFFECTS OF ^{60}Co ON ELECTRICAL SELF-STIMULATION OF THE BRAIN AND BLOOD PRESSURE IN MONKEYS. Bruner, A. (Lovelace Foundation for Medical Education and Research, Albuquerque, NM). Aerosp. Med.; 45: 1058-1061(Sep 1974).

The effects of 1000 and 2000 rads ^{60}Co on electrical self-stimulation of subcortical brain areas and blood pressure were investigated to determine whether radiation-induced performance decrement occurs in a like manner for a positively rewarded behavioral task as it does for the more typically studied shock-avoidance task. During the early postradiation minutes, self-stimulated responses decreased or ceased and resumed shortly thereafter, revealing a similar course of performance decrement as seen with shock-avoidance, discrimination tasks. Early postradiation hypotension with subsequent recovery paralleled the performance decrement, reproducing the blood pressure-behavior correlations seen previously with shock reinforcement. The blood pressure-elevating influence of the brain stimulation observed prior to irradiation was diminished or absent during the deep hypotensive stage postradiation, but tended to return minutes later. (IAA)

14367 EFFECTS OF X-IRRADIATION ON THE DISTAL ULNAR GROWTH PLATE IN THE DOG. Carrig, C. B. Davis, CA; Univ. of California (1974). 191p. University Microfilms Order No. 74-29,294.

Thesis (Ph. D.).

Twelve Beagle puppies were irradiated over the distal ulnar growth plate at approximately 9½ weeks of age. A dose of 1,000 rads was given to the center of the growth plate through two opposing ports. Irradiation was carried out using a 200 kVp, 15 ma beam having an HVL of 1.17 mm cu and an FSD of 48 cm. Field size was 1½ square cm. The animals were sacrificed at 3, 7, 14, 28, 56 and 84 days postirradiation. Three puppies were used as controls. Radiography, blood vessel perfusion, and histopathologic studies were used to evaluate the changes occurring at the site of irradiation, the changes in growth of the radius and ulna following retarded growth of the ulna, and the changes in the elbow joint secondary to asynchronous growth of the radius and ulna. The initial radiographic change at the site of irradiation was seen at 3 days postirradiation and consisted of a zone of increased metaphyseal density and an increased width of the growth plate. These changes became more prominent over the first 14 days postirradiation. Subsequently, the metaphyseal density was reduced and metaphyseal trabeculae became coarse. The size of the metaphysis was decreased. Histological changes seen in the growth plate consisted of swelling and disorganization of the rows of cartilage columns, the disruption of the normal process of endochondral ossification, widening of the growth plate, a profound effect on the osteoblasts and marked depletion of the cell population of the marrow. Changes in metaphyseal and epiphyseal blood vessel morphology and function were demonstrated. (Diss. Abstr. Int., B)

14368 STUDY OF THE ACTIVITY OF SOME ENZYMES IN LOVER HOMOGENATE FROM WHITE RATS FOLLOWING X-RAY RADIATION IN THE REGION OF THE MIDBRAIN. Ljubenov, I.; Andreev, B. (Vissh Meditsinski Inst., Plovdiv (Bulgaria)). Folia Med. (Plovdiv); 16: No. 1, 5-8(1974).

The diminished activity of the more important enzymes can be connected to distrophic and functional disturbances. The considerably decreased value of the liver cholinesterase (as a secretory enzyme) was due to disturbances in the protein synthetizing function of the hepatic parenchyma. The decreased values indicator enzymes that act intracellularly was due probably to the permeability of the cell membrane and disturbances of the protein metabolism. The alkaline phosphatase (a purely excretory enzyme) was insignificantly diminished in comparison to the control group. (INIS)

14369 ON THE MECHANISM OF ACTION OF EXCHANGE TRANSFUSION IN ACUTE IRRADIATION DISEASE. Decheva, Z.; Tomova, I. (Nauchno-Izsledovatelski Inst. po Khematologiya i Kryvoprelivane, Sofia (Bulgaria)). Eksp. Med. Morfol.; 11: No. 4, 226-231(1972). (In Bulgarian).

Experiments were made on 48 rabbits, irradiated with 1200 R of roentgenologic rays. The methods of determining sex chromatin in leucocytes were used. The participation of the immunologic mechanism in the unfavourable action of exchange transfusions on nonrejection of bone-marrow transplants in

irradiated animals as well as the role of the stem cells of donor blood in the growth of transplants of bone marrow after exchange transfusion were examined autoradiographically. It was found that, on the one hand, an immunologic moment existed, and, on the other, proliferation of stem cells of the donor blood was of no substantial significance under the given conditions. (auth)

14370 EFFECT OF IONIZING RADIATIONS ON RAT LIVER REGENERATION. Effect of Irradiation Before Partial Hepatectomy. Markov, G.; Petrov, P.; Desev, G.; Tsanev, R. Izv. Inst. Biokhim., Bulg. Akad. Nauk.; 4: 215-226(1973). (In Bulgarian).

Male albino rats weighing 180 to 200 g were irradiated with 1000 and 4000 rad of γ rays. Liver regeneration was induced by removing ⅔ of the liver one hour later. The irradiation dose did not affect the optical density profile and the radioactivity distribution among the various cytoplasmic and nuclear RNA fractions obtained by electrophoresis on agar gel. RNA was labelled with orthophosphate (^{32}P) injected immediately after the partial hepatectomy. The specific radioactivity of RNA remained unaltered. The nucleotide composition of the total and the newly synthesized cytoplasmic and nuclear RNA also remained unchanged. (auth)

14371 EFFECT OF BETA RADIATION ON HEALING OF CORNEAL WOUNDS. Vrabec, J. (Charles Univ., Prague). Cesk. Otolaryngol.; 29: No. 5, 327-330(Sep 1973). (In Czech).

In an experiment in rabbits using impregnation with silver, the effect of beta radiation on the healing of corneal wounds was studied. In the upper third of the limbal circumference a subtotal keratotomy was performed, its central part was irradiated by a contact beta applicator with an effective area of 6 mm in diameter. The rabbits were first exposed on the fifth day after incision at a time of fully developed cellular activity. The total doses were 5000, 7500, and 10,000 rad. A marked slowing down of healing in the irradiated part of the incision was found. The character of the alterations and the result of the irradiation at a time of full cellular proliferative activity agrees with literary descriptions of the healing of corneal incisions in previously irradiated corneas. The study shows that the slowing down effect of beta radiation does not depend on the time interval in relation to the incision, but only on the dose of radiation. (Nucl. Sci. Abstr. Czech)

14372 EFFECT OF LOCAL IRRADIATION OF THE SKIN PROTECTED BY CALCIUM PANTOTHENATE. Ghircoiasiu, M.; Clichici, M.; Uray, Z. (Babes-Bolyai Univ., Cluj). Compt. Rend. Soc. Biol.; 167: No. 12, 1830-1833(1973). (In French).

Rats were given calcium pantothenate and their skin was locally irradiated. The effect of irradiation on glycogen, lactic acid, and cholesterol metabolism in the liver and skin was followed in protected and controlled rats. The administration of calcium pantothenate resulted in a decrease of skin cholesterol, whereas the aerobic amount of liver cholesterol remained the same and degradation of skin glucides was enhanced. Calcium pantothenate has a protective effect on liver. (FR)

14373 EFFECT OF POST-RADIATION BLEEDING ON THE HEMOPOIESIS IN CHICKENS. Rusov, Ch.; Mladenov, L.; Boikov, S.; Petrovoch, P. Izv. Inst. Srav. Patol. Shivotn., Bulg. Akad. Nauk.; 14: 197-212(1972). (In Bulgarian).

Parallel experiments were performed with White-rock chickens at 2 months of age divided into three groups: subject to bleeding (30 per cent of the whole blood); irradiated with x rays (twice at a rate of 2000 R on the course of 20 hours) and irradiated together with bleeding (under the same conditions). Dynamics and intensity of regeneration of the hemopoiesis in the three groups of chickens were followed up and compared by means of hematological, histological, and electron-microscopic investigations. Special attention was paid to the group subject to irradiation and bleeding. The studies revealed that the post-radiation bleeding exerts a stimulating effect on the regeneration of the hemopoiesis in the obligate and nonobligate hemopoietic organs. As a result of this, an earlier and more intensive restoration of the cell composition of the periphery blood started. It is assumed that the enhanced formation of erythropoietin due to bleeding plays an important role in this process. (auth)

14374 CHANGES IN THE PERIPHERAL BLOOD OF EWES AND LAMBS AFTER SKINPAINTING WITH ^{90}Sr. Jordanov, I.; Ivanov, A.; Gromkov, N. Izv. Inst. Srav. Patol. Shivotn., Bulg. Akad. Nauk.; 14: 241-246(1972). (In Bulgarian).

Studies were carried out on the changes in the peripheral blood of ewes and lambs induced by painting 400 sq.cm of skin with ^{90}Sr (0.5 to 1 μCi per sq.cm). It was ascertained that the dose of 200 μCi induces a slight reduction of the number of erythrocytes, on the 15th day in ewes, and on the 20th day in lambs. In both cases there was a decrease in the hemoglobin content in the 15th day. The number of leucocytes also dropped—on the 9th day in ewes, and on the 4th day in lambs. On the 20th day the number of erythrocytes and the hemoglobin content in most of the ewes returned to the level prior to treatment. The leucocytes increased, but by the end of the experiment it did not reach the level before treatment. In a lamb treated with a twice as high dose (400 μCi) in addition to the changes mentioned above there were also changes in the morphology of some of the cells in the erythrocyte order. (auth)

14375 RADIATION PROTECTIVE EFFECT OF A MIXTURE OF ATP, AET AND SEROTONIN ON YIELDS OF 600 R X-RAY-INDUCED CHROMOSOME ABERRATIONS. Baev, I.; Benova, D. (Nauchno-Izsledovatelski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Compt. Rend. Acad. Bulg. Sci.; 25: No. 8, 1128-1131(1972).

The radioprotective effect of ATP, AET, and serotonin in double or triple combination against chromosomal aberrations in rat bone marrow cells after exposure to 600 R x rays was studied. Reduced doses from the radioprotectors were used: ATP, 120 mg, AET, 80 mg, and serotonin, 4 mg/kg b.w., injected intraperitoneally 15, 10, and 5 minutes before irradiation, respectively. Preparations for cytogenetic analysis were made 18 hours after the irradiation. Pretreatment only with ATP does not change the yields of chromosomal aberrations in comparison with the irradiated nonprotected animals, but ATP in combination with AET or serotonin decrease with 50% the number of cells with structural chromosomal aberrations. The double combination of AET and ATP is more effective in comparison with the triple one (with added serotonin). (INIS)

14376 EFFECT OF IONIZING RADIATION ON THE SUSCEPTIBILITY OF ORGANISM TO INFECTION AND ON NATURAL IMMUNITY MECHANISM. Miler, I.; Mandel, L. (Ceskoslovenska Akademie Ved, Prague. Mikrobiologicky Ustav). Cesk. Fysiol.; 22: No. 6, 545-563(Dec 1973). (In Czech).

Refs.

A review is presented of the effect of microbial flora on the survival time, hematologic changes, GIT injury, and on the result of bone marrow therapy in animals exposed to ionizing radiation. The microbial flora is shown to be a complex factor in the response of exposed animals to irradiation through alterations in the normal anatomical and physiological state of the organism. Investigations of the effect of individual type of microbes on the exposed organism may be facilitated using germ-free animals. They are considered to be an experimental model, which also makes it possible to gain profound knowledge of the mechanism of the effect of ionizing radiation on the living organism. (INIS)

14377 COMPARATIVE STUDIES ON GLYCINE (C^{14}) INCORPORATION IN LIVER PROTEINS AFTER RADIATION. Chobanova, D. Compt. Rend. Acad. Bulg. Sci.; 26: No. 8, 1117-1120 (1973).

The changes in glycine incorporation in liver proteins under x-irradiation approximately and without characteristic accents follows the outline of the modified metabolitic path of amino acids of the cysteic order. On the 2nd day after irradiation, cysteine synthesis is higher, which corresponds to the highest values of incorporation of these amino acids in the protein fraction of postribosomal supernatant. (auth)

14378 THE INFLUENCE OF ACUTE RADIATION SICKNESS ON THE LEVEL OF PROTEIN AND PROTEINIC FRACTIONS IN PLASMA OF RABBITS. Krynski, A. (Szkola Glowna Gospodarstwa Wiejskiego, Warsaw (Poland)). Med. Wet. (Poland); 28: 99-101(1972). (In Polish).

Investigations were carried out on 25 male rabbits irradiated using x rays. The total irradiation dose (DL50/30) was 910 R. The animals were irradiated under 200 kV, 20 mA, filter Cu 1 mm. The concentration of total protein was determined by the biuret method, the level of individual protein fractions was estimated on paper electrophoretically. In sick animals there was observed statistically significant decrease of plasma total proteins. The level of albumins in acute radiation sickness diminished, the concentration of gamma globulins decreased in the peak period of the disease. There was not observed statistically significant changes in the concentration of alpha and beta globulins. (auth)

14379 RADIOPROTECTIVE EFFECT OF GROUNDNUT OIL ON SKIN. Ghanekar, S. P.; Korgaonkar, K. S. (Cancer Research Inst., Bombay (India). Biophysics Div.). Indian J. Cancer; 9: No. 3, 216-222(1972).

Studies were conducted to see the effect of groundnut oil on rabbits as well as Wistar rats, which had their skin locally irradiated with 70 kV and 220 kV x rays in the radiotherapy dose range. Radioprotective effects of groundnut oil were clearly noted in the results. (auth)

14380 THE EFFECT OF CHRONIC IRRADIATION WITH SMALL DOSES OF GAMMA RAYS ON THE CONDUCTION SPEED IN N.ISCHIADICUS IN RATS. Kilimov, N. I.; Krushkov, I. Kh. Compt. Rend. Acad. Bulg. Sci.; 26: No. 12, 1701-1703(1973).

Male rats were irradiated every day with 2.0 ± 0.2 rads for the course of 8 months (total dose average 400 rads). Electromyographic studies were carried out one month after the end of the treatment. Determination of the conduction speeds in the peripheral nerve motor fibres (including also the conduction speeds in the synapses and in the muscle fibres themselves) does not show difference between irradiation and control animals. The peripheral nerve conductivity is not affected by chronic radiation involving small doses of gamma rays. (INIS)

14381 RADIOPROTECTIVE EFFECT OF CYTROPHOS UNDER CONDITION OF FRACTIONATED EXPOSURE TO X RAYS. Bokova, N.; Pantev, T.; Nikolov, I. (Nauchno-Izsledovatelski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Rentgenol. Radiol.; 12: No. 2, 129-134(1973). (In Bulgarian).

The radioprotective properties of cytrophos were studied on mice exposed to triple irradiation with 400 R at three-day intervals between procedures. The compound was introduced 15 minutes before each exposure in a dose of 700 mg/kg. The total irradiation dose of 1200 R in this fractionation scheme was absolutely lethal for control animals. The survival rate was much higher and the main duration of life much longer in cytrophos-protected animals. Parallel studies were devoted to the effect of cytrophos on bone marrow, spleen, and thymus cellularity, splenic and small intestinal weight and the dynamics of the body weight changes in protected and in irradiated animals. (auth)

14382 EFFECTS OF CHRONIC IRRADIATION ON COMPLEMENT CONSUMPTION IN NORMAL SERA. Chlebovska, K.; Cabadaj, S.; Chlebovsky, O.; Praslicka, M.; Bernasovsky, I. (Univerzita P.J. Safarika, Kosice (Czechoslovakia). Prirodovecka Fakulta). Biologia (Bratislava); 28: No. 12, 961-968(1973). (In German).

The complement consumption by normal rat sera after chronic gamma irradiation is discussed. After daily doses of 40 R and 80 R, no substantial changes occurred in the reaction within 40 days; at most intervals a minor increase could be observed in the reaction rate. After daily doses of 120 R, a decreased rate of the reaction was observed 4 days after the irradiation. From the 4th day on, a marked decrease was found in the number of lymphocytes in peripheral blood in all irradiated groups. (auth)

14383 INFLUENCE OF UV RADIATION ON THE DIURNAL RHYTHM OF ACID PHOSPHATASE ACTIVITY IN THE LIVERS OF MICE IN CUTANEO-MUSCULO-PERITONEAL PARABIOSIS. Litynska, A. (Jagiellonian Univ., Krakow). Folia Biol. (Krakow); 22: No. 4, 385-397(1974).

Acid phosphatase activity was studied in fractions of liver homogenates from mice in cutaneo-musculo-peritoneal parabiosis. One of the partners in parabiosis was uv-irradiated, and acid phosphatase activity was assayed in both partners every 6 hours during one day. The results were compared with a control group of non-irradiated mice in parabiosis. Ultraviolet irradiation caused significant quantitative changes in acid phosphatase activity and in its rhythm in the first hour after irradiation in both partners. In the subsequent hours normal rhythm returned in the non-irradiated partner, and in the irradiated partner a second minimum of activity occurred after 24 hours. The appearance of the reaction in both partners, of which only one had been irradiated, suggested transmission of information through the blood circulation, although a certain role of the nervous system cannot be excluded. (auth)

14384 GERM CELL CHROMOSOMAL TRANSLOCATIONS IN RATS GIVEN FOETAL X IRRADIATION. Baev, I.; Bairakova, A. (Research Inst. of Radiobiology and Radiation Hygiene, Sofia). Folia Biol. (Krakow); 22: No. 4, 369-371(1974).

Male rats were given in utero acute 50 R x irradiation on post-conception day 15, 16, 17, 18, 19, 20, 21, or 22. At maturity (100 days), preparations were made of their testes for cytogenetic analysis. Frequencies of reciprocal translocations scored in spermatocytes at diakinesis — metaphase I are reported and compared with corresponding frequencies following a similar dose of spermatogonial irradiation. (auth)

14385 REPAIR OF RADIATION DAMAGE AT LETHAL DOSES. Korgaonkar, K. S.; Ghanekar, S. P. (Cancer Research Inst., Bombay). Proc. Indian Nat. Sci. Acad., Part B; 39: No. 4, 541-548 (Aug 1973).

From symposium on photochemical and photophysical processes in biological systems; New Delhi, India (27 Jan 1972).

Dose range LD_{10} to LD_{90} in most mammals is found to be very narrow. There appears to be a threshold for irreparable damage leading to death of the mammals. However, the sites and nature of lesions for reparable as well as irreparable injury are still obscure. One of the methods to study this phenomenon would be to look out for the agents that can protect the organism in this relevant dose-range. Such investigations were undertaken in this laboratory. Some of these observations are presented and discussed. (auth)

14386 EFFECT OF X-RAY IRRADIATION ON LEARNING PROCESSES AND NUCLEIC ACID CONTENT IN THE BRAIN OF RATS. Zamkova, L. S.; Chaychenko, G. M. Visn. Kiiv. Univ., Ser. Astron.; No. 16, 49-53(1974). (In Russian).

In the process of irradiating rats a change in the content of RNA is noted, DNA changes have not been determined. Non-fixated, temporary bonds are subject to a greater effect of ionizing radiation. Changes in the content of nucleic acids under the influence of x-ray irradiation coincide basically with phase changes of fixated conditioned reflexes of the rats. That is, molecules of RNA play a definite role in the process of fixation of temporary bonds. (Referativnyi Zh.)

14387 INFLUENCE OF PROTAMINE–ADENOSINE TRIPHOSPHATE ON THE SURVIVAL OF LETHALLY IRRADIATED RATS. Dantev, T. P.; Bokova, N. V.; Nikolov, I. T. Kosm. Biol. Aviakosmicheskaya Med.; No. 2, 85-86(1974). (In Russian).

A synthetic method for protamine-ATP (I) has been reported along with data on its effect on the survival of irradiated rats. It has been shown that I administered by gavage at a dose of 250 mg/kg 15 to 20 min prior to irradiation at 840 roentgens exhibits a definite protective action. Administration of I prevented the death of 80% of animals. A favorable effect of I on the intestinal and marrow syndromes has been established. (Referativnyi Zh.)

14388 CHANGES IN THE LEVELS OF HYDROXYPROLINE CONTAINING COMPOUNDS IN THE PLASMA AND URINE FOLLOWING IRRADIATION. Nesterova, V. I.; Davydova, S. A.; Poluboyarinova, Z. I.; Vodyakova, L. M. Med. Radiol.; 19: No. 3, 51-56(1974). (In Russian).

Investigations were conducted on the concentrations of collagen metabolites in the plasma and urine of white rats with acute radiation sickness and local radiation trauma. In acute radiation sickness (950 roentgen dose) plasma levels of protein bound hydroxyproline decreased on the 1st day, with subsequent increase on the 3rd day. With an 800 roentgen dose the decrease was noted somewhat later, on the 4th day, and excretion of hydroxyproline increased by the 4th and the 5th day. The resultant changes are interpreted by the authors as reflecting enhanced collagen catabolism in conjunction with inhibition of its synthesis. In the case of radiation beta burns, increased excretion of hydroxyproline on the 2nd day may indicate early destructive changes in collagen prior to the development of erosive and ulcerating skin lesions. By the 3rd week following the burn, excretion of hydroxyproline decreases significantly which, apparently, was due to inhibition of the repair processes in the connective tissues. (Referativnyi Zh)

14389 BIOLOGICAL RADIATION SENSITIZATION BY QUINONOID COMPOUNDS. Chandramouli, K.; Srinivasan, N. G.; Sivaramakrishnan, V. M. (Cancer Inst., Madras). Proc. Indian Nat. Sci. Acad., Part B; 39: No. 4, 512-515(Aug 1973).

From symposium on photochemical and photophysical processes in biological systems; New Delhi, India (27 Jan 1972).

The Vitamin K analog, Synkavit (2-methyl 1, 4-naphthohydroquinone diphosphate, tetrasodium salt) functions as a radiosensitiser in certain cases of malignant tumors. It undergoes enzymatic dephosphorylation in the system; the resulting quinone is presumed to be the actual sensitiser. Synkavit and five other phosphate-containing quinonoid analogues were found to undergo enzymatic dephosphorylation at widely varying rates. An attempt has been made in this study to correlate the rates of dephosphorylation of three typical derivatives to their radiosensitizing abilities. Groups of partially hepatectomized rats were given 1000 rads whole-body γ radiation with or without prior intravenous administration of the test compounds. Subsequently ^{32}P was administered and the extent of labelling of DNA in the regenerating livers measured. Synkavit and its 3-methyl derivative (2, 3-dimethyl 1, 4-naphthohydroquinone diphosphate, tetrasodium salt) are found to greatly potentiate the inhibition of ^{32}P incorporation into DNA by gamma rays. These compounds are also readily dephosphorylated. On the other hand, 2, 3, 5, 6-tetramethyl 1, 4-benzohydroquinone diphosphate, tetrasodium salt, which undergoes only negligible enzymatic dephosphorylation, is also found to have little effect on the action of γ rays on DNA synthesis. There is good correlation between the rate of dephosphorylation and the radiosensitizing ability of these compounds. It is concluded that dephosphorylation is a prerequisite to radiation-sensitization by these compounds. The results also reveal that the quinones are the actual radiation-sensitizers. (auth)

14390 RADIATION-INDUCED ALTERATION IN TOAD ERYTHROCYTE AND HEMOGLOBIN. Guha, T.; De, M. L. (Saha Inst. of Nuclear Physics, Calcutta). Proc. Indian Nat. Sci. Acad., Part B; 39: No. 4, 506-511(Aug 1973).

From symposium on photochemical and photophysical processes in biological systems; New Delhi, India (27 Jan 1972).

Changes induced by x radiation in toad erythrocytes and in aqueous solutions of hemoglobin were studied. Whole blood of the animal was collected from the ventricle with heparin as anticoagulant. The whole blood, containing erythrocytes in its own plasma, was exposed to 30 kiloroentgens of x radiation. Samples containing erythrocytes in diluted plasma and in saline only were irradiated with a dose of 18 kR. Slide smears were prepared from all the radiated as well as the unradiated blood samples. The slides were examined under the microscope and the erythrocytes were photographed. The photomicrographs of the radiated cells showed some morphological changes in comparison with the normal unradiated cells. It was also observed that cells suspended in plasma were more radiation resistant than cells in saline. Then hemoglobin, separated from normal erythrocytes by osmotic hemolysis, was subjected to graded dose of x radiation up to 48 kR. Absorption spectra of the irradiated samples were compared with that of unirradiated hemoglobin. The usual α, β, and γ absorption peaks were noted at 570 mμ, 535 mμ, and 414 mμ respectively for the unradiated hemoglobin solution. The extinction coefficients of the three peaks had relative values of 1.07 : 1 : 8.3 respectively. Hemoglobin solution irradiated with a dose below 12 kR showed an absorption spectrum similar in general nature to that of unirradiated solution; the 3 peaks however, decreased in value and the Soret peak (γ) shifted from 414 mμ to 410 mμ. With doses higher than 12 kR, the first two peaks tended to vanish, specially the β one; the Soret peak, which remained, gradually decreased in magnitude with increase in dose. In addition, this peak showed a gradual shift towards shorter wavelengths from 410 mμ at 12 kR to 407 mμ at 48 kR. Some explanations have been suggested to account for the observed phenomena. (auth)

14391 HISTOCHEMICAL AND BIOCHEMICAL ALTERATIONS IN RABBIT CORNEAS AFTER X IRRADIATION. Cejkova, J. (Ophthalmological Lab., Prague); Simkova, M.; Bolkova, A. Cesk. Otolaryngol.; 29: No. 5, 331-336(Sep 1973). (In Czech).

Rabbit corneas were irradiated with x rays. In the first out of three experimental groups the corneas were irradiated with a single dose of 4000 R, the corneas in the second group with a dose of 8000 R (twice 4000 R at a time interval of one week), and in the third group with 12000 R in three doses of 4000 R with two intervals of one week. The rabbits of all experimental groups were sacrificed after 6 weeks and the corneas were examined histologically, histochemically for acid mucopolysaccharides, and biochemically by the determination of hexosamines and uronic acid. In the corneas, no serious histological alterations were found. The x rays seriously affected the mucopolysaccharide metabolism of the cornea early after irradiation. The amount of acid mucopolysaccharides significantly decreased and the corneal stroma was hydrated depending on the degree of irradiation. (Nucl. Sci. Abstr. Czech.)

Invertebrates

14392 (IAEA-R-542-F) DEVELOPMENT OF MASS PRODUCTION TECHNIQUES IN THE ARTIFICIAL REARING OF THE OLIVE FLY DACUS OLEAE GMEL. Part of a Coordinated Program of Fruitfly Eradication or Control by the Sterile-Male Technique. de Magalhaes Silva, G. (International Atomic Energy Agency, Vienna (Austria)). Mar 1974. vp. INIS.

The olive fly is the main pest of the olive which is its only host. It develops in the fruit thereby lowering the yield and market value of this crop. Because of environmental pollution and the upsurge of secondary pests which the chemical control of the olive fly cause, efforts are being made to develop suppression of this pest by the sterile male technique. One of the main requirements for the application of this method of control is a technology for mass producing the insect in the absence of its host. The objective of this project was to improve artificial media for larval development, adult maintenance, egg collection and pupal stocking. Among the various nutrients and antimicrobial agents tested in the larval diets, none consistently improved pupal yield. However, ground corn cobs (provided they were insecticide-free) and eucalyptus paper pulp were effective and economical substitutes for the cellulose powder filler. A large (120 × 60 × 25 cm) adult cage holding up to 1,500 flies with a possible density of over 80 flies/litre gave low initial mortality and normal overall longevity. This cage was combined with an effective and simple egg collecting device consisting of stretched parafilm forming the 2 largest sides of the cage. Maintaining the pupae at 7° and 11°C for 5 days alternately allowed pupal stocking for 90 days with only 30% mortality. (INIS)

14393 RADIATION INDUCED SEMI-STERILITY FOR GENETIC CONTROL PURPOSES IN THE ONION FLY HYLEMYA ANITIQUA (MEIGEN). P. 1. Isolation of Semi-Sterile Stocks and Their Cytogenetical Properties. Wijnands-Staeb, K. J. A. (Instituut voor Toepassing van Atoomenergie in de Landbouw, Wageningen (Netherlands)); Heemert, C. van (Landbouwhogeschool Wageningen (Netherlands). Lab. voor Erfelijkheidsleer). Theor. Appl. Genet.; 44: No. 3, 111-119(1974).

2 figs.; 3 tabs.; 15 refs.

In the preliminary stages of a study into the use of translocations for genetic control of the onion fly Hylemya antiqua (Meigen), irradiations were carried out in order to obtain chromosomal rearrangements. Several irradiation experiments, with x ray or fast neutrons, were carried out on pupae and adults of both sexes at substerilizing doses below 3.0 krad, to establish a favorable way of induction. Because no visible markers are available for the genetic screening of induced rearrangements, and the reciprocal translocations or inversions in demand express themselves in the heterozygous condition by reduced fertility, a total of 234 F_1 individuals of both sexes were checked for reduced fertility. 50 F_1 individuals were suspected of carrying a translocation or inversion when they produced an egg hatch of between 30 and 60% (semi-sterility). This category was passed for cytogenetic analysis. In the progeny of 25 suspect F_1 individuals, 9 different rearrangements were established, of which 7 were translocations. This means a yield of 4% for all the tested F_1. After a discussion of the normal karyotype, some of the observed rearrangements are described. Irradiation of males with 1.0 krad of x rays is advised for the production of semi-sterile stocks carrying translocations. Fast neutrons were not found to be better than x rays. At doses higher than 1.0 krad complex rearrangements and/or fragments were observed. A translocation homozygote could be isolated in the case of an x-autosomal translocation, and this stock will be used for further genetic control purposes. (INIS)

14394 STUDIES ON THE REACTION OF THE HOUSEFLY (MUSCA DOMESTICA L.) TO THE PRESENCE OF RADIATION OF GAMMA-RAYS. Vasilev, I. B.; Lyvchiev, V. I.; Ivanova, R. G. (Bylgarska Akademiya na Naukite, Sofia; Sofia Univ. (Bulgaria). Biologicheski Fakultet). Compt. Rend. Acad. Bulg. Sci.; 25: No. 9, 1269-1271(1972).

Behaviour of a group of insects (Musca domestica L.) subjected to periodic irradiation with low doses of gamma rays was studied. An insectarium was constructed specially to this end and irradiation of the feeders performed during feedings. The flies seem to sense the radiation. Food placed under the effect of irradiation prior to feeding does not change its composition. The flies avoid only the food which is irradiated when they are eating it. During the relatively brief period of the experiments the flies acquired a certain conditioned reflex in relation to the position of the feeder which has an irradiation device underneath. A certain adaptation to the irradiation was also observed. (INIS)

14395 EFFECT OF GAMMA RAY TREATMENT OF SPIROCHAETES OF THE BORRELIA ANSERINA, SACKHAROFF, 1891 SPECIES. Yankov, I.; Sumrov, I.; Stefanova, M. Vet. Med. Nauki (Sofia); 10: No. 5, 25-30(1973). (In Bulgarian).

Gamma treatment of borrelia anserina spirochaetes brings about a graded drop in their virulence. Losing partly their virulence the spirochaetes retain their immunogenic properties. The presence of spirochaetes in the bird's organism leads in all cases to a certain change in the pattern of the immunologic response. The duration of immunity is at least 120 days (up to the end of the experimental period). (auth)

14396 RADIOSENSITIVITY OF THE OOCYTES IN SITOTROGA CEREALELLA OLIV. Dryanovska, O. A.; Glavanakova, S. I. (Bylgarska Akademiya na Naukite, Sofia). Compt. Rend. Acad. Bulg. Sci.; 25: No. 2, 253-254(1972).

One-day female imagos of the grain moth (Sitotroga cerealella Oliv.) were irradiated with 10 or 50 kR gamma rays (^{60}Co). Immediately after the irradiation they were allowed to copulate with non-irradiated males. Eggs were collected at 12 hour intervals and hatching followed up to the 12th or 13th days after irradiation. The results obtained indicate that the eggs laid during the first day (24 hours), which had been in the state of metaphase I during the irradiation, show a lower percentage of hatching compared with eggs laid during the second day (irradiated in the state of late prophase (diakinesis)). The conclusion is that oocytes at first metaphase of the meiosis are more radiosensitive in comparison with oocytes in late prophase if genetic radiation effects are scored (dominant lethal mutations). Hypotheses concerning the mechanism for the difference in the radiosensitivity of the oocytes in this stage are discussed. (INIS)

14397 CONCERNING THE INFLUENCE OF X-RAYS ON THE SILK MOTH (BOMBYX MORI L.). II. Change in the Technological Qualities of Cocoons and Raw Silk. Yankov, A.; Petkov, N.; Jolov, A. Zhivotnovud. Nauki; 10: No. 10, 129-133(1973). (In Bulgarian).

A study was conducted in 1971 and 1972 concerning the influence of x rays on some technological qualities of silk moth cocoons and raw silk on irradiation of silkworm seed in D_3 and E_3 embryonal stages with varying doses: 500, 1000, 1500 and 2000 R. The x-ray source used was the x-ray apparatus TH-250 (Filter 0.5 Ci, 20 m 200 KV) at 40 cm distance, $^{10}/_{15}$ tube and intensity of the exposure 145.1 R/min, air temperature of 25°C and relative humidity of 48 to 50 per cent. The study concerned the white cocooned breed II-Ya, each of the subvariants being made in 3 replications of 200 silkworm seed each. It was found that irradiation of silkworm seed in D_3 and E_3 stages with x rays in doses of 500 and 1500 R enhances the silk per cent of dry cocoons by 0.4 to 3 per cent, the raw silk per cent by 0.5 to 1.4 points and raw silk yield per ounce of silkworm seed by 0.280 to 0.700 kg. Raw silk elasticity rose by 0.2 to 1.2 per cent and its b.m. value rose by 22 to 65 h.m. (auth)

14398 COMBINED EFFECT OF INFRARED AND ULTRAVIOLET RAYS ON SOME SILK MOTH (BOMBYX MORI L.). Yankov, A.; Jolov, A.; Petkov, N. Zhivotnovud. Nauki; 10: No. 6, 121-126 (1973). (In Bulgarian).

The combined effect of infrared and ultraviolet rays treatment on the biological development of the silk moth was investigated from the first day of the incubation period to bleaching of the silkworm seed. The combined quartz lamp type "MLKK-5" (500 W, 220 V) served as a source of simultaneous flow of infrared and ultraviolet rays, the irradiation dose being 4, 8, and 2 for five min daily. The combined effect of infrared and ultraviolet rays during the incubation period resulted in shortening of the incubation period by 24 to 34 hrs, of the larval period by 47 to 59 hrs and in raising the crude cocoon yield per g silkworm seed by 0.23 to 0.71 kg. A tendency toward lowering silkworm seed hatchability and silkworm survival was observed at higher irradiation doses (8 and 2 for 5 min). (auth)

14399 EFFECT OF INFRARED AND ULTRAVIOLET RAYS ON THE HATCHABILITY RATE AND THE INCUBATION PERIOD OF SOME WHITE-COCOON BREEDS AND HYBRIDS OF THE SILK MOTH (BOMBYX MORI L.). Yankov, A.; Petkov, N.; Jolov, A. Zhivotnovud. Nauki; 10: No. 5, 123-128(1973). (In Bulgarian).

A combined quartz lamp type MLKK-5 (500 W, 220 V) was used at exposures of 30 and 45 min for infrared rays, and single exposures of 4 min, as well as for double exposure, each of 4 min per day, for ultraviolet rays. The breeds 48-I and 157-K and the hybrids 11-Ya × 48-I and (48-I × 157-K) × (11-Ya × 48-I) were investigated in three replications, each of 200 seeds. The irradiation with both infrared and ultraviolet rays during the whole incubation period resulted in an increase in the hatchability rate of the seed by 0.83 to 3.50 per cent, and shortening the incubation period by 1.2 to 2.2 days. The stimulation effect on hatchability and duration of the incubation period is different in the various breeds and hybrids of the silk moth. (auth)

14400 EFFECTS OF RADIATIONS ON THE RATE OF REGENERATION IN HOMALOZOON VERMICULARE (STOKES) AND UROSTYLA. Kasturi Bai, A. R.; Dilli, L. (Univ., Bangalore, India). Indian J. Exp. Biol.; 12: No. 4, 343-345(Jul 1974).

Effects of exogenous uv and x irradiation and intracellular irradiation with tritiated water were studied on the rate of regeneration of the ciliates, Homalozoon vermiculare, having a moniliform macronucleus and Urostyla sp., possessing multiple macronuclei (over 100 in number). The ciliates were cut into approximately 2 equal halves, and the time taken to regenerate the lost parts at 26° ± 1°C was observed; this served as the control. The time taken for regeneration after irradiation was compared with that of the control. Irradiation with uv at a wavelength of 2537 Å, immediately after cutting, for 15 min was lethal. The capacity to regenerate increases with the increase in the time allowed to recover before irradiation. X irradiation for 5 and 10 min at 85 KV and 5 mA delayed the process considerably. A specific activity of 2.5 mCi/ml of tritiated water retarded the process of regeneration in Homalozoon, while it was lethal to Urostyla, whereas 1.5 mCi/ml delayed the process of regeneration in both the ciliates. (auth)

Radionuclide Effects (Internal Source)

Man

Refer also to abstracts 13696, 13770, 14016, 14047–14049, 14082, 14096, 14342, 14347, 14350, 14351, 14357, 14422, and 15801–15805.

14401 (CEA-R-4604) RADIOTOXICOLOGICAL SUPERVISION OF PERSONS EXPOSED TO CONTAMINATION BY TRITIATED WATER. Briot; Chiadot; Domergue. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Nov 1974. 13p. (In French). Dep. NTIS (US Sales Only) $4.00.

After a brief survey on the metabolism of tritiated water and the legal norms used in health physics, theoretical and practical aspects of the radiotoxicological supervision of exposed persons are considered. The equations necessary for calculation of the doses involved are given, the systematic supervision procedure is defined, and a line of conduct to adopt in the event of accident is recommended. (auth)

14402 (CONF-740115-, pp 79-86) MEASUREMENT OF PLUTONIUM IN HUMANS. Lawrence, J. N. P. (Los Alamos Scientific Lab., NM). Dec 1974.

From plutonium information meeting; Los Alamos, New Mexico, USA (4 Jan 1974).

In plutonium information meeting.

There are many uncertainties involved in estimating the plutonium that might be in humans, whether direct in vivo measurements or excretion analysis, coupled with elimination equations, working backward to estimate what is in a person are used. Both of these procedures involve many errors. All such estimates depend on the detection of the emitted particles from the decaying Pu, i.e., either the photons from the daughter products of the α particles and the β particles themselves. In chest and wound monitoring, the concern is with the low-energy x rays or the 60-keV γ rays that might be emitted. The 60-keV gamma ray is from americium, and the low-energy x rays are from the daughter products of Pu and Am. In excretion analysis, the concern is primarily with the α emissions after chemical separation of the Pu from urine. The decay scheme and half-life of ^{236}Pu, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Pu, ^{242}Pu, and ^{241}Am are reviewed. Detectors and detection methods are discussed. (CH)

14403 (CONF-740115-, pp 87-96) HUMAN EXPERIENCE AS RELATED TO PLUTONIUM. Richmond, C. R. (Los Alamos Scientific Lab., NM). Dec 1974.

From plutonium information meeting; Los Alamos, New Mexico, USA (4 Jan 1974).

In plutonium information meeting.

Information available to date on the biological effects of Pu in man is summarized. This includes information on 25 men occupationally exposed during 1944 and 1945 and followed for almost three decades by periodic biomedical examinations; a group of 18 men given tracer doses of ^{238}Pu or ^{239}Pu in 1945 and 1956; a few accident cases resulting in Pu contamination; and approximately 190 early and current Pu workers registered in the US Transuranium Registry, some of whom have been exposed to relatively high levels of Pu and some of whom have been exposed to low levels of Pu over a number of years. No pathological changes attributable to Pu have been observed. (CH)

14404 (CONF-741219-3) TABLES OF AVERAGE DOSE TO AN ORGAN PER MICRO-CURIE DAY ACCUMULATED BY A RADIONUCLIDE IN A SOURCE ORGAN. Snyder, W. S.; Ford, M. R. (Oak Ridge National Lab., Tenn. (USA)). 1974. 16p. Dep. NTIS $4.00.

From first Asian regional congress on radiation protection; Bombay, India (15 Dec 1974).

The equation for average dose to a target organ of reference man per unit residence in a source organ S can be written as $\bar{D}(T \leftarrow S) = U(S)\ D(T \leftarrow S)$ where U(S) is the microcurie days accumulated in organ S and depends on the metabolism of the radionuclide while $D(T \leftarrow S)$ is the dose delivered from the source S to the target organ T per microcurie day of the nuclide in S and this involves little biology; principally the mass of the organ and the distribution of the source in S. There is little information on this distribution and in consequence the health physicist usually assumes it to be uniform. A tabulation of $D(T \leftarrow S)$ is described for sources distributed uniformly in the principal organs of reference man and for the target organs usually considered. The total average dose to target organ T is obtained by summing on the source organs. For a beta emitter in bone, the dose to the active marrow and to endosteal cells is taken from the results of Spiers. For photons the methods developed by the authors in MIRD Pamphlet No. 5 are used. These are supplemented by use of the build-up factor given by Berger, MIRD Pamphlet No. 2. The basis of the calculations will be described. The tabulation is to be published as a laboratory report. (auth)

14405 (CONF-750109-1) CALCULATIONAL TECHNIQUES FOR ESTIMATING POPULATION DOSES FROM RADIOACTIVITY IN NATURAL GAS FROM NUCLEARLY STIMULATED WELLS. Barton, C. J.; Moore, R. E.; Rohwer, P. S.; Kaye, S. V. (Oak

Ridge National Lab., Tenn. (USA)). 1974. 25p. Dep. NTIS $4.25.

From 4th IAEA panel on peaceful nuclear explosives; Vienna, Austria (20 Jan 1975).

Techniques for estimating radiation doses from exposure to combustion products of natural gas obtained from wells created by use of nuclear explosives were first developed in the Gasbuggy Project. These techniques were refined and extended by development of a number of computer codes in studies related to the Rulison Project, the second in the series of joint government-industry efforts to demonstrate the feasibility of increasing natural gas production from low-permeability rock formations by use of nuclear explosives. These techniques are described and dose estimates that illustrate their use are given. These dose estimation studies have been primarily theoretical, but the hypothetical exposure conditions correspond as closely as possible with conditions that could exist if nuclearly stimulated natural gas is used commercially. (auth)

14406 (ORNL-TM-4768) COMPARISON OF THE POTENTIAL RADIOLOGICAL IMPACT OF RECYCLE ^{233}U HTGR FUEL AND LMFBR PLUTONIUM FUEL RELEASED TO THE ENVIRONMENT. Till, J. E. (Oak Ridge National Lab., Tenn. (USA)). Jan 1975. Contract W-7405-eng-26. 26p. Dep. NTIS $4.50.

The anticipated use of recycle ^{233}U fuels in High Temperature Gas-Cooled Reactors (HTGR) has prompted the need to review the radiological implications of this material. The recycle uranium is primarily ^{233}U, but it also contains up to 1200 ppM ^{232}U. The highly radiotoxic ^{232}U contributes from 50% to 90% of the internal dose to man from this recycle uranium. The INREM, BIORAD, TERMOD, and AIRDOSE codes were used to predict potential hazards to man and biota from hypothetical exposure to recycle ^{233}U fuel and LMFBR plutonium fuel. From a radiological impact standpoint, LMFBR plutonium fuel is approximately 500 times more radiotoxic than ^{233}U fuel when inhalation is the exposure pathway. In terms of doses to man via ingestion and doses to biota the two fuels are comparable. It is concluded that if atmospheric release is the only source of effluent, LMFBR plutonium fuel is more hazardous than recycle ^{232}U fuel by a factor of approximately 500; however, if these fuels are predominantly present in the terrestrial environment, their radiological impact on man is similar. (auth)

14407 OCCULT THYROID CARCINOMA IN OLMSTED COUNTY, MINNESOTA: PREVALENCE AT AUTOPSY COMPARED WITH THAT IN HIROSHIMA AND NAGASAKI, JAPAN. Sampson, R. J.; Woolner, L. B.; Bahn, R. C.; Kurland, L. T. (Mayo Clinic, Rochester, MN). Cancer; 34: No. 6, 2072-2076 (Dec 1974).

Nine occult carcinomas of the thyroid were found in 157 autopsies of deceased residents of Olmsted County, Minnesota, a prevalence of 5.7%. This rate is significantly lower than that reported from a previous autopsy series from Hiroshima–Nagasaki, Japan, in which similar pathologic methods and diagnostic criteria were used. Sex ratio, age distribution, and radiation exposure are considered not to explain this difference. A true difference between the Japanese and American populations with respect to the prevalence of occult thyroid carcinoma is the most likely explanation of these findings. (auth)

14408 RESEARCH ON THE BIOLOGICAL EFFECTS OF ATMOSPHERIC POLLUTANTS. Lafuma, J. (CEN, Fontenay-aux-Roses, France). Bull. Inform. Sci. Tech. (Paris); No. 191, 91-95(Apr 1974). (In French).

The real biological problem arising from atmospheric pollutants is the induction of lung cancer. Mention is also made of chronic secondary infections and of alveolar clearance troubles, which aggravate the toxic effect of pollutants. The results of an experimental study on an animal subjected to a lung overcharged with the dust of various chemical substances (silica, coal, titanium oxide) are described. It is found that as the weight of dust increases, the clearance rate of the alveolus diminishes. A study was also made of the effect of radioactivity on alveolar clearance by subjecting animals to dust intakes of plutonium 239 nitrate. A phenomenon similar to that found for stable dusts is noticed. Finally as part of the research work on lung cancer induction by inhaled radioelements the conclusion is reached that the better the dispersion of an inhaled radioelement in the lung the greater is its toxicity and it is probably more cancer forming. Cancers of the lung induced in rats compare in every way with those observed in man subjected to conventional or radioactive pollutants. (FR)

14409 EFFECT OF THE WORKING ENVIRONMENT ON THE METABOLISM OF RED BLOOD CELLS OF MINERS IN DEEP URANIUM MINES. Pehr, F. (Ustav Hygieny Prace v Uranovem Prumyslu, Pribram, Czech.). Ind. At. Spatiales; 18: No. 3, 17-32 (May 1974). (In English and French).

Changes in the red cell metabolism from venous blood of miners from uranium mines, which developed as a consequence of the working hazard, were investigated. From the methaemoglobin reduction test and the methaemoglobin level attention is drawn to deviations inside the red cells. The relationship between the rate of methaemoglobin reduction and the number of years underground was expressed by a grade 3 parabols with the maximum after 4.6 years of work in the mines. A similar relationship, which was almost the mirror image of the former relationship was observed in the blood methaemoglobin level, with the minimum after 3.6 years in the mines. The haemoglobin content bound in the red cell membrane and the cholinesterase activity of stromas provided evidence of alteration of the red cell membranes. The relationship between the haemoglobin content in the stromas and the number of years underground could be expressed by two grade-two parabolic branches with the point of intersection after 5.5 years work in the mines. The cholinesterase activity first declined briskly and then had a mildly descendent trend. It was possible to express the relationship by a hyperbola of general shape $(ax + b)/(cx + d)$. (FR)

14410 DOSIMETRY AND TOXICITY OF $^{197}HgCl_2$. Valeyre, J. (Centre Regional de Lutte Contre le Cancer, Reims, France). pp 163-166 of Renal Uptake of $^{197}HgCl_2$. Raynaud, C. (Comp.). Paris; Masson (1973). (In French).

Because of the high uptake of ^{197}Hg by the kidney and the smallness of the kidney-ovary distance, it is absolutely necessary to measure the radiation doses received by the kidneys and the ovaries. The doses of radiation absorbed by adults and children are given for Hg administered in the form of $^{197}HgCl$. It was observed that only slight renal and gonad irradiation occurs. It is nevertheless inadvisable to perform more than 3 examinations on the same individual if the quantities injected are relatively large (300 μCi for adults and 125 μCi for children). The chemical toxicity of stable Hg injected in the form of $HgCl_2$ is negligible. (FR)

Animals

14411 (BNWL-SA-5215) PULMONARY PATHOLOGY INDUCED BY PLUTONIUM IN BEAGLES. Dagle, G. E.; Park, J. F. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Dec 1974. Contract AT(45-1)-1830. 14p. (CONF-741222-1). Dep. NTIS $4.00.

From annual meeting of the American College of Veterinary Pathologists; Chicago, Illinois, USA (6 Dec 1974).

Pulmonary changes induced by ^{239}Pu in beagles in relation to radiation dose following aerosol exposure are reviewed. Plutonium-239, with a half-life of about 24,360 years, emits α particles with 5.1 MeV energy that causes necrosis of cells. The predominant toxic effect of plutonium is caused by the radioactivity emitted. The necrosis causes fibrosis, compensatory hyperplasia of epithelial cells, and associated changes characterized as radiation pneumonitis. If the animals do not die of radiation pneumonitis, primary pulmonary neoplasia develops. The distribution of ^{239}Pu in pulmonary tissues following inhalation of aerosols and the phagocytosis of Pu particles by macrophages in the lungs are described. (CH)

14412 (CONF-740115-, pp 30-55) BEHAVIOR OF PLUTONIUM IN ANIMALS AND MAN. Durbin, P. (Univ. of California, Berkeley). Dec 1974.

From plutonium information meeting; Los Alamos, New Mexico, USA (4 Jan 1974).

In plutonium information meeting.

The chemical properties of Pu that are important in biological studies are reviewed. These include valence state, hydrolysis, insolubility of compounds, and formation of complexes. It is pointed out that biological data are obtained using pure Pu compounds and nearly pure Pu isotopes (usually $^{239}Pu(IV)$), but that in modern reactor and fuel-processing technology the Pu is not likely to be pure either chemically or isotopically since reactor Pu is mixed and the presence of ^{238}Pu raises its specific activity to a level considerably higher than that of ^{239}Pu. Data are reviewed from a number of studies on the tissue distribution of ^{239}Pu in laboratory animals following administration by injection, ingestion, inhalation, or direct skin or wound contamination using highly soluble Pu citrate, slightly soluble PuO_2, or insoluble PuO_2 ceramic microspheres. Emphasis is placed on mechanisms of Pu binding by blood proteins, Pu transport in blood and lymph, absorption from the gastrointestinal tract and by respiratory tract tissues, retention by bone tissues, lymph nodes, liver, spleen, kidneys, and lungs, and excretion in urine and feces.

The initial distribution of Pu in rats is compared with that of other actinide elements which were available for study in 1960. Data available on Pu distribution in man are also included. (CH)

14413 (CONF-740115-, pp 56-63) EFFECTS OF PLUTONIUM IN ANIMALS. Thompson, R. C. (Battelle Pacific Northwest Labs., Richland, WA). Dec 1974.

From plutonium information meeting; Los Alamos, New Mexico, USA (4 Jan 1974).

In plutonium information meeting.

Animal experiments with Pu are useful to the extent that they help predict the hazards to personnel from occupational exposure and the hazards to the general population from environmental exposure. Data are reviewed from a number of studies on the delayed effects on experimental animals of internal irradiation from ^{239}Pu in relation to dose. The acute effects of ^{238}Pu and ^{239}Pu in rats and dogs were compared. On the basis of these findings it was calculated that an internally deposited dose of about 10 μCi/kg induced death. For a 70-kg man this would be about 10 mg of ^{239}Pu or about 40 μg of ^{238}Pu. Plutonium distributed environmentally and available for inhalation by the human population will probably be in the form of insoluble particles and will be inhaled in very small numbers by any given individual. If the radiation dose from these particles is averaged over the total lung it would be extremely low but in the microvolume of tissue surrounding the particle it would be much greater. Implications in recommending maximum permissible inhalation doses are considered briefly. (CH)

14414 INHALED RADIOELEMENTS. LaFuma, J. (CEN, Fontenay-aux-Roses, France). Radioprotection; 9: No. 1, 15-25 (1974). (In French).

From radiobiological seminar on internal contamination; Paris, France (18 Mar 1974).

The results described fall within the framework of long-term research aiming at studying the pathological effects of inhaled radioelements, namely plutonium-239 oxide, americium-241 nitrate and curium-244 nitrate. A DL 50 value was determined for each radioelement and for each physical-chemical form. This DL 50 rises from the curium-244 nitrate to the plutonium-239 oxide. The differences observed are linked to the number of cells affected, which depends on the degree of heterogeneity of radioelement distribution. Many cancers were obtained during the experiments. These cancers had histological types identical to certain human cancers. Irrespective of the dose, the first animals to die showed metaplases, those living on then had non-malignant tumors, and it was in those living the longest that cancers were found. This systematic succession of cellular damage foreshadows the possibility of interpreting the various different mechanisms entering into cancer induction. (FR)

14415 OBSERVATIONS ON THE INDUCTION OF MUTATION BY IONIZING RADIATION IN RATTUS RATTUS SSP. Medina, F. I. S.; de la Cruz, B.; Madriaga, C. L.; Eslit-Barber, S. P.; Evarretta, V. P.; Gregorio, J. S. 8: No. 3, 28-30(Mar 1973).

An experiment on the effects of ionizing radiation on the control of field rats was carried out by the Biomedical Research Department of the Philippine Atomic Energy Commission. This involved production of lethal genes induced by internal radiation. ^{32}P and tritiated thymidine (^{3}THDN) were administered. The animals (P_1) were fed creep pellets after which they and their succeeding generation (Fn) were observed for physical abnormalities and other changes such as hair texture, color, and degree of furring. Results were: a. Hairless in R. r. mindanensis, believed to be sterile. These mutants (F_2) came from P_1 given 125 uCi ^{3}HTDN (both male and female): b. Large head in R. argentiventer, this was cast by a P_1 given 50 uCi ^{3}THDN where only the male was dosed, believed to be sterile after mating; c. Satin like fur in R. r. mindanensis, the group is an F_2 from a P_1 dosed with 312.5 uCi ^{3}HTDN; d. Albinism in R. argentiventer; e. Runts (Diminution), seen in most of the F_2, F_3, of P_1 administered either ^{32}P or ^{3}HTDN of different doses (50 uCi to 300 uCi); f. Eye-cataract, on field rats given either ^{32}P of ^{3}HTDN of varying dose either in F_1 or succeeding generation. Observations indicate the latent potential of induced genetic translocation utilizing internal and/or external sources of ionizing radiation as a means of controlling field rat population. (INIS)

14416 PERSISTENT CHROMOSOME ANOMALIES IN RAT BONE-MARROW CELLS FROM STRONTIUM-89. Bairakova, A. (Research Inst. of Radiobiology and Radiation Hygiene, Sofia). Folia Biol. (Krakow); 22: No. 4, 373-376(1974).

Cytogenetic analysis of rat bone marrow cells was carried out 6 months following intraperitoneal administration of 1.5 μCi/g b. w. of strontium-89 (LD50/180). The percentage of aberrant cells was found to be increased in relation to controls (10.3% vs. 3.7%) and was accounted for by cells with acentric fragments and symmetric exchanges. Exposed animals showed either solitary aberrant cells or aberrant cell clones, with some animals revealing no cytogenetic anomalies. (auth)

14417 COLONY FORMING UNIT SUICIDE IN NORMAL AND RAUSCHER LEUKEMIC MICE GIVEN TRITIATED THYMIDINE IN VIVO. O'Kunewick, J. P.; Phillips, E. L. (Allegheny General Hospital, Pittsburgh). Exp. Hematol.; 2: 9-15(1974).

The effect of large doses of high specific activity ^{3}HTdR on transplantable CFU was evaluated in Rauscher leukemic mice. ^{3}HTdR was injected in two different manners: short-term (3 injections, 20 minutes apart) and long-term (6 injections, 4 hours apart). Both techniques resulted in a significant CFU suicide in the leukemic mice and in the normal controls. The results showed that in terms of relative proportion approximately the same ratio of CFU are killed by the tritiated thymidine in the Rauscher leukemic mice and in the controls. This is in sharp contrast with the situation found with AKR lymphoma where a much greater ratio of tumor cells are killed by ^{3}HTdR suicide in vivo. Analysis of the data indicates that in Rauscher leukemia a significant number of the new spleen CFU, which arise as a result of the leukemia, pass out of an actively cycling state into either a G_0 state or a cycle in excess of 24 hours, and that the number of these is of the order of 4 times the total number of cycling and non-cycling CFU found in the normal mouse. The suggestion is made that Rauscher leukemia might serve as a suitable model for human cancers which are thought to produce a large number of non-cycling neoplastic cells. (DG)

14418 PROLIFERATIVE AND NEOPLASTIC CHANGES IN THE OVARIES OF HAMSTERS TREATED WITH ^{131}I AND METHYLTHIOURACIL. Khristov, K.; Raichev, R. (Cancer Research Inst., Sofia). Neoplasma; 20: No. 5, 511-516(1973).

The appearance and the structure of ovarian tumors in hamsters treated with ^{131}I and methylthiouracil alone or in combination were studied. Modular cell proliferation and tumor growth were observed in 90 per cent of all ^{131}I-injected animals killed between the 600th and the 620th days after the beginning of the experiment. The induced tumors were mainly of the granulosa and granulosa-theca cell type. A diffuse hyperplasia was found of the ovarian mesenchymal-stromal cells resulting from methylthiouracil and from combined ^{131}I + methylthiouracil treatment. The histogenesis of ovarian tumors and the effect of ^{131}I and methylthiouracil on the ovarian carcinogenesis in hamsters are discussed. (Nucl. Sci. Abstr. Czech)

Nuclide Kinetics and Toxicology

Refer also to abstract 14100.

Man

Refer also to abstracts 14016, 14017, 14037, 14401, 14409, 14450, 14457, 14461, 14462, and 14485.

14419 (LA-UR-74-1963) ORIGIN OF CURRENT STANDARDS. Healy, J. W. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 16p. (CONF-740550-3). Dep. NTIS $4.00.

From 2nd annual life sciences symposium on plutonium—health implications for man; Los Alamos, New Mexico, USA (22 May 1974).

It is of importance that the basis for any radiation protection standard be understood by those who propose to use it or change it. In the case of ^{239}Pu, the maximum permissible body burden was derived by biological comparison with ^{226}Ra, for which the maximum permissible body burden was derived from human data. The dose distribution factor and present methods of calculation of dose equivalent in bone arose from this estimate on the assumption that all of the Pu was in the bone of the the test animals. The current MPCs for insoluble materials are based on dose only to the lung without consideration of the transfer to the remainder of the body. (auth)

14420 ENVIRONMENTAL SURVEILLANCE AROUND NUCLEAR INSTALLATIONS: THE HOUR FOR REALISM. Pellerin, P. (Service Central de Protection Contre les Rayonnements Ionisants, Le Vesinet, France). pp 3-15 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974). (In French).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); CONF-731117-(P1).

In the last 25 years innumerable studies have been carried out on the various aspects of possible radioactive contamination of the

environment by nuclear installations. Apart from the Windscale incident (the consequences of which were in any case very minor) no really serious situation has ever been recorded. On the basis of the most pessimistic assumptions, the anticipated development of the nuclear industry up to the year 2020 could perhaps result in an additional dose to the population of the order of a hundredth of that from natural radiation. Despite a general increase in plant capacity, technological developments have increased the safety of nuclear installations to a level rarely equalled in other industries, which makes a serious accident highly improbable. During this period medical radiodiagnosis, despite progress in radiation protection, has continued practically to double natural radiation, and its use is increasing on average by 10% per year in the advanced countries. It would be unreasonable in these circumstances to continue to expend efforts and vast sums of money on further developing surveillance around nuclear installations; it is already fully adequate and should be confined to routine operations which are now well defined for each type of installation. On the other hand, everything necessary should be done to ensure that these operations are carried out effectively and systematically in all cases. A return to realism is therefore essential for the following reasons: so as not to create artificially a more and more paradoxical situation, disquieting to the public, which would be bound ultimately to be exploited against the interests of nuclear power, and so as not to retard the necessary development of nuclear energy, and to avoid unjustified squandering of resources on the protection side. (auth)

14421 OBJECTIVES OF MONITORING A NUCLEAR INSTALLATION. Nagel, E. (Eidgenoessisches Institut fuer Reaktorforschung, Wuerenlingen, Switzerland). pp 61-64 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974). (In French).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); CONF-731117-(P1).

The regulations for the protection of the population in the vicinity of a nuclear installation are becoming increasingly stringent. The personal dose rates permitted during normal operation are very low, so much so that direct measurements are practically impossible. For surveillance purposes one can rely, in the case of more or less continuous gas releases, on average annual radioactivity concentrations at the source itself; these measurements are relatively easy to make, but the calculation models used to derive individual doses received by people in the vicinity provide only approximate values. Temporary build-ups of emission cannot be reflected in the calculation of annual averages unless they are relatively frequent. Otherwise they have to be considered separately, because during emissions of short duration the dispersion factor at a particular site can differ by one or two orders of magnitude from the average annual factor. This can, moreover, substantially alter the critical population dose rate. Moreover, there is a growing trend towards the construction of nuclear power stations in the vicinity of densely populated areas, which could result in a steady increase in the total population dose. This will also have to be taken into account in the future. (auth)

14422 LEAD-210 IN BULGARIAN CIGARETTES AND CIGARETTE SMOKE. Nikolova, M. E. (Nauchno-Izsledovatelski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)); Parfenov, Yu. D. (Institut Biofiziki, Moscow (USSR)). Rentgenol. Radiol.; 11: No. 1, 7-13(1972). (In Bulgarian).

Lead-210 content in the tobacco of ten brands used in Bulgarian cigarettes is ranged between 0.304 and 0.444 pCi and is average 0.375 ± 0.023 pCi per cigarette. During smoking 0.038 – 0.005 pCi ^{210}Pb (10.1% of the total ^{210}Pb in a cigarette) passes into the mainstream of smoke cigarette. Ratio of ^{210}Po/^{210}Pb in cigarette tobacco is 0.78 – 0.97 and in the mainstream of smoke is 1.37 – 2.08. The daily intake of lead-210 from smoking 20 Bulgarian cigarettes was 0.76 pCi. Using a recent model established by the ICRP, dosage to the pulmonary compartment of the respiratory system was calculated. As a result of regular daily smoking of Bulgarian cigarettes radiation burden to the lung of man is 0.0008 mrem/year from lead-210; 0.11 mrem/year from bismuth-210 and 15 mrem/year from polonium-210. (auth)

14423 PRECAUTIONS TO BE TAKEN WITH THE LIVER, SPLEEN, AND INTESTINE. Jacquot, C.; Raynaud, C. (Hospitalier Frederic Joliot, Orsay, France). pp 52-57 of Renal Uptake of $^{197}HgCl_2$. Raynaud, C. (Comp.). Paris; Masson (1973). (In French).

$HgCl_2$ is preferentially fixed by the kidney but also builds up in the liver, spleen, and mucous membrane of the colon. Concerning the colon, the activity of the stools evacuated during the 3 days following $^{197}HgCl_2$ injection can reach 5% of the injected dose and this may interfere with the kidney outline reading. It is therefore necessary to speed up transit in the colon by daily administration of mild laxatives. The liver fixes all the more Hg as the kidney fixes less, the amount fixed and retained reaching up to 25% of the injected dose in pathological subjects. This necessitates a subtraction of the hepatic activity and the advantages and disadvantages of different methods are discussed. Mercury is fixed by the spleen during the first 24 hours and this fixation decreases rapidly with time. A superposition of the spleen and left kidney can hinder the reading of the outer edge of the latter and lead to an overestimation of the renal fixation rate. The validity of the spleen and liver activity subtraction method using a colloid is discussed. (FR)

14424 TRITIUM CONTAMINATION AND EXTRACORPOREAL DIALYSIS. Henry, P. (Centre de Marcoule, Bagnols-sur-Ceze, France). Radioprotection; 9: No. 1, 41-83(1974). (In French).

From radiobiological seminar on internal contamination; Paris, France (18 Mar 1974).

When there is heavy internal tritium contamination, it becomes necessary to use a therapy to speed up the rate of water renewal in the system. The purpose of this work is to determine the efficiency of extracorporeal dialysis methods to hasten the elimination of tritiated water. The experimental results show that it is possible to lower the biological half-life in man to 13 hours by peritoneal dialysis and to less than 4 hours by hemodialysis. The choice of the nature and duration of the treatment must be based on the calculation of the dose involved; in actual practice there is hope of reducing this to 5% of its initial value. (FR)

14425 RENAL Hg UPTAKE MEASUREMENT BY EXTERNAL COUNTING. Verhas, M.; Goossens, R. (Hospital Universitaire Brugmann, Brussels). pp 5-15 of Renal Uptake of $^{197}HgCl_2$. Raynaud, C. (Comp.). Paris; Masson (1973). (In French).

$^{197}HgCl_2$ is used in concentrated solution of about 10 mCi/ml sterile and acid (pH 4). The injection doses are about 300 μCi in adults and can be reduced to 100 μCi minimum in children. Forty-eight hours after injection a renal scintigram is carried out on the patient lying face down, in order to locate and delimit the kidneys. External counting is performed with a Na/Tl crystal-equipped probe and a wide-angle collimator. The corrections needed to account for the perirenal activity and the kidney depth are mentioned, after which the renal fixation calculation method is described. This technique is simple to use and well tolerated by the patient. It is easily repeated on the same subject and the equipment required is inexpensive. (FR)

14426 INTERNAL RADIO-CONTAMINATION THERAPY. Present Aspects and Future Prospects. Ducousso, R. (Centre de Recherches du Service de Sante des Armees, Clamart, France); Pasquier, C.; Nenot, J. C. Radioprotection; 9: No. 1, 27-39(1974). (In French).

From radiobiological seminar on internal contamination; Paris, France (18 Mar 1974).

Therapeutic data evolution between the 50's and 60's is analysed by separating the contaminating radioelements into two categories: transferable elements and non-transferable elements. Current therapeutic data are then presented, stressing the concept of urgency valid for all contaminations by any radioelement and irrespective of the entrance door. DTPA, in particular, has enabled enormous progress to be made in the treatment of internal contamination in the last ten years. It is virtually absolutely efficient on ions of the most dangerous nuclides, plutonium and transplutonium elements, if administered immediately after the accident. In the case of insoluble oxides, the efficient action of the surgeons in the case of wounds and the development of lung washing in the case of inhalation permit efficient decontamination. (FR)

14427 COMPARATIVE EVALUATION OF THE NATURAL URANIUM AND IODINE CONTENTS IN THE PATHOLOGICALLY CHANGED THYROID GLAND. Malenchenko, A. F.; Shkil, T. V.; (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ennergetiki). Zdravookhr. Beloruss.; No. 7, 21-23(1972). (In Russian).

The concentration of U and I in the normal and pathologically changed thyroid tissue (with endemic goiter) was studied. The inverse dependence between these indicators was established. The concentration of iodine in the thyroid and the level of its functional activity seem to be the factors determining the concentration of U in the thyroid tissues. (tr-auth)

14428 ERYTHROCYTE CAPACITY OF BONDING URANYL IONS. Drazanova, S.; Nosek, J. (Inst. of National Health in Uranium Industry, Pribram, Czech.). Cas. Lek. Cesk.; 112: No. 44, 1364-1366(2 Nov 1973). (In Czech).

The capacity was investigated in erythrocytes of bonding uranyl ions, aiming at the clarification of the dependence of the uranyl ion bonds on the concentration of uranyl salt and the clarification of the erythrocyte capacity saturation. The amount of uranium bonded in erythrocytes was found to increase with increasing concentration of uranyl salt in the suspension. The dependence was exponential and was only found valid up to a concentration of

4.4 μg U/ml. In heavily diluted suspensions of uranyl salt, erythrocytes were found to bond uranyl ions also against the concentration gradient. Comparison of the data with the findings of a significantly increased content of uranium in the erythrocytes of uranium miners showed that the miners' erythrocytes had bonded ten times less uranium as had been their maximum bonding capacity. (Nucl. Sci. Abstr. Czech.)

14429 CAPACITY OF URANIUM MINERS' ERYTHROCYTES OF BONDING URANYL IONS. Drazanova, S.; Nosek, J. (Inst. of National Health in Uranium Industry, Pribram, Czech.). Cas. Lek. Cesk.; 112: No. 44, 1366-1369(2 Nov 1973). (In Czech).

The capacity of uranium miners erythrocytes to bond uranyl ions was studied in vitro. In the experiment, erythrocyte samples were used of miners' working underground for less than 10 years and of miners working underground for 10 years and more. Uranium miners' erythrocytes in vitro were ascertained to have lower capacity of bonding uranyl ions than erythrocytes in controls. The differences were significant with all five concentrations or uranyl salt used. Significant differences were also found between the two experimental groups of uranium miners' erythrocytes, varying with the concentration of uranyl salt. The reduced bonding capacity of erythrocytes is attributed to the fact that erythrocytes in uranium miners' in vivo bond a certain amount of uranyl salt, which reduces their bonding capacity in vitro. The difference is also due to the fact that uranium miners' erythrocyte stromata in vivo gradually change their average biological structure and this alters their capacity in vitro. The actual amount of uranium found in uranium miners' erythrocytes was ~40 times smaller than would correspond to the maximum capacity of erythrocytes of bonding uranyl salt. (Nucl. Sci. Abstr. Czech.)

Animals

Refer also to abstracts 14030, 14031, 14077, and 14500.

14430 (LA-5661) STUDIES OF PLUTONIUM, AMERICIUM, AND URANIUM IN ENVIRONMENTAL MATRICES. Adams, W. H.; Buchholz, J. R.; Christenson, C. W.; Johnson, G. L.; Fowler, E. B. (Los Alamos Scientific Lab., N. Mex. (USA)). Jun 1974. Contract W-7405-eng-36. 26p. Dep. NTIS $4.00.

A nitric acid-hydrofluoric acid treatment for dissolution of plutonium oxides in soils was developed; its adaption to other biological matrices is discussed. Plutonium recoveries of 94 to 99% from 1-g samples of spiked and heated soils are reported. Adaptation of the acid solution to subsequent anion exchange separation of plutonium, followed by coupling to known electroplating techniques, is described. The uptake of plutonium, americium, and uranium from spiked soils by alfalfa, beans, radishes, lettuce, tomatoes, and barley is reported. The apparent solubility of $^{238}PuO_2$ in tap water was measured, and the deposition of plutonium in fish, algae, and snails in aquaria containing $^{238}PuO_2$ microspheres is reported. (auth)

14431 HYDRATION OF RABBIT CORNEAS AND ^{45}Ca UPTAKE IN VITRO. Role of Epithelium and of Endothelium. Obenberger, J.; Dobiasova, M. (Ceskoslovenska Akademie Ved, Prague. Oftalmologicka Laborator); Bibicky, A. (Ceskoslovenska Akademie Ved, Prague. Isotopova Laborator Biologickych Ustavu). Cesk. Oftalmol.; 30: No. 1, 3-8(Jan 1974). (In Czech).

The effect on ^{45}Ca uptake of hydration of corneas resulting from the removal of the epithelium and endothelium was studied. The corneas were incubated and the resulting experimental swelling was compared in vitro with the intensity of ^{45}Ca uptake for normal corneas and the corneas with the epithelium and the endothelium removed. An increased hydration was observed in all experimental groups; to a lesser degree in normal corneas, with values growing for the corneas with excised endothelium, epithelium, and for isolated stromata. The differences between the respective groups were highly significant. The relationship of inverse proportion was observed for the uptake of ^{45}Ca. The highest uptake values were found for normal corneas; the lowest uptake was observed in the isolated stroma. (INIS)

14432 IMPORTANCE OF THE POLONIUM 210 DETERMINATION IN THE URINE OF WORKERS IN URANIUM MINES. Panov, D.; Petrovich, D.; Novak, L.; Dzhordzhevich, V. (Institute of Work Medicine and Radioprotection, Belgrad (Yugoslavia)). Suvrem. Med.; 23: No. 11, 6-10(1972). (In Bulgarian).

Results are reported from a study on 299 workers in the uranium mines of Yugoslavia exposed to the effect of radonium together with parallel experiments on rats. It is impossible to determine the whole contamination with radonium and its degradation products by testing the urine for polonium-210. No correlation exists between the concentration of polonium 210 in the urine and the concentration of radonium in the labour environment. It is determined the minimal admissible dose of polonium 210 up to 1.5 pCi/l in the urine. (auth)

14433 EARLY PHASES OF PLUTONIUM-239 METABOLISM AFTER PERORAL ADMINISTRATION IN THE ANIMAL ORGANISM. Nechev, Kh. (Institut za Spetsializatsiya i Usyvyrshenstvuvane na Lekarite (ISUL), Sofia (Bulgaria)). Rentgenol. Radiol.; 12: No. 3, 171-174(1973). (In Bulgarian).

The early phases of plutonium-239 metabolism, after peroral administration in the form of $PuCl_3$ are discussed. The skeletal type of radionuclide distribution in the organism is emphasized. The coefficient of radioisotope absorption by the gastrointestinal tract was determined according to an original technique by administering the radionuclide in the portal vein, which enables the barrier function of the liver to be demonstrated and more exact results to be obtained. Plutonium-239 absorption coefficient determined according to the author's technique differs by 22 per cent from the one determined by the hitherto used technique. (auth)

14434 EARLY PHASES OF PLUTONIUM-239 METABOLISM WITH THE RADIOISOTOPE INTRODUCED AT VARIOUS SITES OF THE VASCULAR SYSTEM. Nechev, Kh. (Institut za Spetsializatsiya i Usyvyrshenstvuvane na Lekarite (ISUL), Sofia (Bulgaria)). Rentgenol. Radiol.; 11: No. 2, 92-96(1972). (In Bulgarian).

The characteristic features of plutonium-239 metabolism in the rat organism when the isotope has been introduced at different sites of the vascular system (v. jugularis and v. portae) are discussed. Under these conditions of administration the nature of radionuclide distribution in the organism was modified. The role of the liver in radioisotope distribution is pointed out. Entering the intestines via the bile plutonium-239 returns to the blood in another chemical state resulting in a modified distribution of the radioisotope in the organism. (auth)

14435 PHYSICO-CHEMICAL STATE OF PLUTONIUM-239 IN RAT BLOOD PLASMA AND TISSUES. Nechev, Kh. (Institut za Spetsializatsiya i Usyvyrshenstvuvane na Lekarite (ISUL), Sofia (Bulgaria)). Rentgenol. Radiol.; 12: No. 2, 107-112(1973). (In Bulgarian).

The physico-chemical state of plutonium-239 in the blood plasma, liver tissue, and bones following intravenous administration (in the jugular and portal veins) of plutonium chloride was studied. An almost complete conjugation of the radioisotope with plasma and liver proteins was noted. In bone tissue plutonium-239 conjugates with the organic and inorganic fraction. Early redistribution of the radionuclide in the bone tissue was obtained; this led to an increase in its amount in the organic substance. The introduction of plutonium in different areas of the vascular system does not affect the formation of complex radioisotope compounds in the organism. (auth)

14436 COMPARATIVE STUDY ON THE DISTRIBUTION OF POTASSIUM-42 AND CAESIUM-137 IN PIGEON TISSUES. Eapen, J.; Narayanan, N. (Bhabha Atomic Research Centre, Bombay (India). Biology Div.). J. Anim. Morphol. Physiol.; 19: No. 1, 50-53(1972).

Studies on relative uptake of K and Cs by muscles of pigeon were carried out. There is an ebb and flow in the uptake of ^{42}K muscles as a function of time during the period between 1 and 24 hr. after administration. Apart from muscles the pancreas accumulates large amounts of radiopotassium. The uptake of ^{42}K by white muscle, cardiac muscle, red muscle, and smooth muscle is enhanced when ^{137}Cs is enhanced in red muscle and cardiac muscle but not in other muscles. The highest concentration of ^{42}K is observed in all the tissues 18 hr. after injection whereas ^{137}Cs deposition in cardiac muscle and red muscle is maximum 1 hr. after administration. The interrelationship of K and Cs in muscles is discussed. (auth)

14437 RADIOPHOSPHORUS CUMULATION IN RAT TESTICLES WITH INHIBITED FUNCTION. Kolarov, P.; Panajotov, D.; Milanov, S.; Dashev, G.; Protich, M. (Institut za Spetsializatsiya i Usyvyrshenstvuvane na Lekarite (ISUL), Sofia (Bulgaria)). Rentgenol. Radiol.; 11: No. 2, 82-86(1972). (In Bulgarian).

^{32}P cumulation in rat testicles after preliminary inhibition of the gonad by blocking the gonadotropins was studied. Radiophosphorus incorporation was followed up after the administration of indicatory dose. The curve showed a characteristic course with a maximal percentage of cumulation within 4 to 24 hours after isotope administration, followed by a descending curve. In control animals there was a second peak of radiophosphorus cumulation on the 7th day. This difference is considered specific for the reduced testicular function in animals with blocked gonadotropic hormones. The use of ^{32}P cumulation in the testicles is presumed to be a perspective test measuring the functional activity of male gonad in patients with hypogonadism. (auth)

14438 EFFECT OF SOME ANTIRADIATION COMPOUNDS ON IODINE-131 UPTAKE BY THE THYROID GLAND OF EX-

PERIMENTAL ANIMALS. Kiradzhiev, G. D.; Hadzhirusev, S. B.; Pantev, T. P. (Nauchno-Izsledovatelski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Rentgenol. Radiol.; 11: No. 1, 19-23(1972). (In Bulgarian).

The effect of cysteamine, serotonine, 2-amino-4-iminothiazole hydrochloride, two derivatives of mercaptoalkylhydrozidine and four of S-omega-carboxyaminoalkyl-isothiourea on the uptake of iodine-131, given in indicator doses, by the thyroid gland was studied in experimental animals (rats). It was established that these substances, which possess the qualities of radioprotectors, induce a decrease in radioiodine uptake by the thyroid gland; by the fourth hour since the onset of the experiment the difference in relation to the control may reach 70.0%. Relationship was also recorded between the degree of radioprotective effect and effect on iodine-131 uptake by the thyroid gland. (auth)

14439 EFFECT OF LACTATION ON THE MOBILIZATION OF ^{203}Pb AND ^{47}Ca IN RATS. Momcilovic, B. (Inst. for Medical Research and Occupational Health, Zagreb). Arh. Hig. Rada Toksikol.; 25: No. 3, 371-373(1974).

The mobilization and transfer of lead and calcium from mother rat to the litter were determined 5 days after a single intravenous application of 2.5 μCi ^{203}Pb and 2 μCi ^{47}Ca on the 4th and 15th day of lactation. Both minerals were mobilized and transferred in significant amounts from mother to the litter. The percentage lead retention in the litter was 4 to 6 times lower than the percentage calcium retention. (auth)

14440 ^{86}Rb FLUX INTERACTIONS IN FROG SCIATIC NERVE MEMBRANE. Palmer, G.; Lewis, R. (Univ. of Calgary, Alberta). Life Sci.; 16: No. 1, 159-169(1 Jan 1975).

Rubidium-86 efflux was measured from voltage-clamped frog sciatic nerves. At zero potential the fluxes were positively coupled in accordance with the long pore model with the number of sites being two. At resting potential, negative coupling was observed. This type of flux interaction was blocked by DNP. Exchange carriers were interpreted as the transport mechanism responsible for the negative coupling. (auth)

14441 LONG-TERM LABORATORY EXPERIMENTS ON THE FIXATION OF VARIOUS ^{106}Ru COMPOUNDS BY FRESHWATER ORGANISMS. Vanderborght, O. (Belgian Nuclear Centre, Mol); Van Puymbroeck, S.; Colard, J.; Bittel, R. pp 31-41 of Environmental Surveillance Around Nuclear Installations. Vol II. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol.2); CONF-731117-(P2).

A long-term experiment (54 days) was designed to study further the influence of salt species, aging, and temperature on the uptake of ^{106}Ru in solution by a freshwater fish and snail. Fixation of ^{106}Ru from the nitrosylchloride, nitrosylnitrite, and nitrosylinitrate salt solutions was compared at 15 and 22°C. The nitrosylchloride was very toxic, as found in previous experiments. Concentration ratios (animal/water) on a fresh-weight basis reached a plateau after 6 to 17 days; mean values up to 80 were found in fish. In contrast with short-term experiments in fresh solutions, no significant difference was found between the uptake of ^{106}Ru from the nitrate and nitrite solution. The intestinal contamination of both snail and fish was very high, notwithstanding that the animals were fasted. The high variability of the ^{106}Ru concentration in the animals was mainly due to the variability in this intestinal contamination. (auth)

Plants

Refer also to abstract 14033.

14442 (BNWL-SA-5161) DEPOSITION OF VARIOUS PLUTONIUM-COMPOUND AEROSOLS ONTO PLANT FOLIAGE AT VERY LOW WIND VELOCITIES. Craig, D. K.; Klepper, B. L.; Buschbom, R. L. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. Contract AT(45-1)-1830. 29p. (CONF-740921-22). Dep. NTIS $4.50.

From atmosphere–surface exchange of particulate and gaseous pollutants symposium; Richland, Washington, USA (4 Sep 1974).

The deposition of polydispersed aerosols of plutonium oxide, hydrated (aged) oxide, nitrate, and citrate onto plant foliage was studied in a low-speed wind tunnel designed for quantitative experimental studies of the interaction of airborne plutonium compounds with plant surfaces. Using concentrations of 1 to 4 nCi $^{238}Pu/cm^3$ and a wind velocity of 1 cm/sec, mean deposition velocities onto both single leaves and canopies have been measured. For log normally distributed aerosols having activity median aerodynamic diameters (AMAD) in the range 0.5 to 1.8 μm and geometric standard deviations (GSD) from 1.6 to 2.4, values of 3×10^{-3} to 2×10^{-2} cm/sec were obtained for single 10-day-old Phaseolus vulgaris L. seedling leaves. The corresponding values for 5- to 6-week-old canopies were 4×10^{-3} to 1×10^{-2} cm/sec. Aerosol size distributions were obtained, using an 8-stage impaction device calibrated in terms of the effective cutoff diameters (ECD) of unit density spheres. The above mean deposition velocities were compared with the expected value based upon the quantity of material in each impactor size range and the corresponding theoretical deposition velocity for each ECD. (auth)

14443 ISOTOPIC COMPOSITION OF TOMATO AND MAIZE WATER. Lesaint, C. (Institut National de Recherches Agronomiques, Versailles, France); Merlivat, L.; Bricout, J.; Fontes, J. C.; Gautheret, R. Compt. Rend., Ser. D; 278: No. 23, 2925-2930(5 Jun 1974). (In French).

The water of maize and tomato seedlings is richer in heavy isotopes than that supplied to their roots. The enrichment does not occur through the roots but through the leaves owing to transpiration. The water of the fruit, coming from the raw sap and the elaborated sap at the same time, has a lower heavy isotope enrichment than that of the leaf water. (FR)

14444 ACCUMULATION OF RADIOACTIVE PHOSPHORUS BY AXILLARY BUDS OF SINAPIS ALBA L. Relation with Prior Intake of Non-Radioactive Phosphate. Sell, Y. (Univ., Strasbourg). Compt. Rend., Ser. D; 278: No. 19, 2441-2444(6 May 1974). (In French).

The prior absorption of nonradioactive phosphate elevates the accumulation of ^{32}P by each of the axillary buds, the more so as the concentration of the solution absorbed is greater. With a 10 g/l concentration, the accumulation grows with the duration of contact with the radioactive source. Hence, it is much greater for 16 hours than for 2 and 6 hours. (FR)

New Tracer Techniques

Refer also to abstracts 13774, 13797, 13798, 14088, 14345, 14349, 14359, 14410, 14423, 14425, and 14437.

14445 (CONF-720132–) THIRD CONFERENCE ON PROSTAGLANDINS IN FERTILITY CONTROL, STOCKHOLM, SWEDEN, JANUARY 17–20, 1972. Bergstroem, S.; Green, K.; Samuelsson, B. (eds.). (World Health Organization, Geneva (Switzerland); Kungliga Karolinska Mediko-Kirurgiska Institutet, Stockholm (Sweden)). 1972. 292p.

Separate abstracts were prepared for three of the 25 papers presented. Other papers discuss various aspects of the administration of prostaglandins to terminate human pregnancy. (CH)

14446 (CONF-720132–, pp 38-59) PROSTAGLANDINS: SEROLOGIC SPECIFICITIES AND ESTIMATION IN BIOLOGICAL FLUIDS. Levine, L.; Cernosek, R. M. G.; Polet, H.; Gershman, H. (Brandeis Univ., Waltham, MA). 1972.

From conference on analytical procedures, metabolism and clinical evaluation; Stockholm, Sweden (18 Jan 1972).

In third conference on prostaglandins in fertility control.

Radioactive prostaglandin antigens were synthesized by coupling the prostaglandin to a copolymer of poly-L-glu-36, L-lys-24, L-ala-35 and L-lyr-5. The tyrosine in the copolymer-prostaglandin conjugate was then labelled with 125 I. The amplification of binding by the multivalent antigen was measured. A modification of the radioimmunoassay which utilizes the binding properties of nitrocellulose membranes to separate hapten-antibody complexes from free hapten and has a liquid scintillation counter, as measuring instrument give the same specificity as the 125 I-multivalent prostaglandin-conjugate antigen or tritium-prostaglandin measured by the double antibody technique. (SW)

14447 (CONF-720132–, pp 69-82) EXTRACTION OF PGE FROM HUMAN SERUM FOR RADIOIMMUNOASSAY. Jaffe, B. M.; Parker, C. W. (Washington Univ., St. Louis). 1972.

From conference on analytical procedures, metabolism and clinical evaluation; Stockholm, Sweden (18 Jan 1972).

In third conference on prostaglandins in fertility control.

A radioimmunoassay system capable of measuring subpicomole amounts of PGE-1 and PGE-2 is described. The prostaglandin is labelled with tritium. Four extraction procedures were evaluated using ethanol extraction, ethyl acetate extraction, ethyl acetate-silicic acid chromatography and chloroform extraction. Extraction with petroleum ether was compared to no extraction. The recovery data, based on recovery of [^3H] PGE-1 radioactivity, is summarized. (SW)

14448 (CONF-720132-, pp 83-91) SOME PRACTICAL CONSIDERATIONS IN THE RADIOIMMUNOASSAY OF THE F PROSTAGLANDINS. Caldwell, B. V.; Brock, W. A.; Gordon, J. W.; Speroff, L. (Yale Univ., New Haven). 1972.

From conference on analytical procedures, metabolism and clinical evaluation; Stockholm, Sweden (18 Jan 1972).

In third conference on prostaglandins in fertility control.

The most important practical considerations of radioimmunoassay methodology are described. Collection and handling of the blood samples, extraction and chromatography of the prostaglandins, the establishment of reasonably stable assay conditions, and validation of the method are discussed. (SW)

14449 (COO-3521-124) BIOLOGICAL EFFECTS OF RADIATION AND RELATED BIOCHEMICAL AND PHYSICAL STUDIES. Proposal 3. Metabolic Studies in Cancer with Radioactive Isotopes. Progress Report, May 1, 1970–May 1, 1971. Laughlin, J. S.; Myers, W. P. L. (Sloan-Kettering Inst. for Cancer Research, New York (USA)). 1971. Contract AT(30-1)-910. 105p. Dep. NTIS $8.25.

Progress is reported on studies of the tissue distribution of new radiopharmaceuticals in dogs and the development of a radioisotope scanning system consisting of a collimated γ camera and computer system. Emphasis was placed on the use of $^{15}O_2$ and ^{133}Xe as tracers in pulmonary function studies, and ^{52}Fe and ^{99m}Tc as tracers in hematopoietic system function studies. Studies in patients included the use of ^{32}P to evaluate liver transplants and ^{47}Ca to evaluate parathyroid function. (CH)

14450 (COO-3521-131) BIOLOGICAL EFFECTS OF RADIATION AND RELATED BIOCHEMICAL AND PHYSICAL STUDIES. Proposal 3. Metabolic Studies in Cancer With Radioactive Isotopes. Progress Report, May 1, 1971–April 30, 1973. Laughlin, J. S.; Myers, W. P. L. (Sloan-Kettering Inst. for Cancer Research, New York (USA)). 31 May 1973. Contract AT(11-1)-3521. 99p. Dep. NTIS $8.00.

Studies on instrumentation and data handling included development of the total organ kinetic imaging monitor; applications of the modulation transfer function to the reduction of image degradation; methodology of absolute quantitative organ scanning; and parallel hole collimator design. Metabolic and improved organ scanning studies included: ^{13}N-labeled ammonium chloride for tumor studies; pulmonary function studies with gaseous tracers to demonstrate acute pulmonary radiation reaction; erythropoietic and phagocytic function studies using absolute quantitative organ scanning; ^{11}C-labeled cyanide as a red cell tag for spleen visualization in animals; evaluation of ^{18}F as scanning agent; studies of ^{67}Ga and ^{73}Se for soft tissue tumor localization; and ^{18}F metabolism in the acutely uremic rat. Metabolic and scanning studies on patients with bone and parathyroid disease included: effect of antitumor therapy on the local kinetics of ^{47}Ca and ^{85}Sr in tumor-invaded bone; the effect of phosphate on mineral metabolism in man and animals; effect of calcitonin on the hypercalcemia of cancer; distribution of injected ^{47}Sc in mice; bone mineralization studies; neutron activation of calcium and other elements; and treatment of chondrosarcoma and chordoma with ^{35}S sodium sulfate. Progress is also reported on studies on feasibility of chemical bonding studies with x-ray spectra. (HLW)

14451 (IAEA-R-722-F) SUCCESSION OF PLANKTON COMMUNITIES AND THEIR PRIMARY PRODUCTIVITY IN ARTIFICIAL WATER RESERVOIRS IN NIGERIA. Final Report. Imevbore, A. M. A. (International Atomic Energy Agency, Vienna (Austria)). Jan 1973. 3p. INIS.

The research project deals with the use of radioisotopic tracer (^{14}C and ^{32}P) techniques to investigate the primary productivity parameters as well as the ecological succession of phyto- and zooplanktons in the fishponds and artificial lakes (e.g. Lake Kainji) in Nigeria. The project's objectives also include the characterization of factors involved in the eutrophication of tropical lakes. The data seem to have indicated that a relatively low productivity of the fishponds in Nigeria may be partially attributed to a low content of phosphorus and nitrogen in the waters serving as one of the major limiting factors. This interpretation has been further substantiated by sudden seasonal rise in primary productivity of the lakes co-incident with the onset of the rainy season and the concomitant leaching of the limiting elements into the water bodies. The data have also been collected on the rate of carbon fixation (^{14}C-bicarbonate) by the phytoplanktons at various water depths as a function of illumination and have been used as one of the bases for the estimation of primary biomass productivity of the lakes. The project's works are continuing and the accumulation of relevant hydrobiological information are aimed at the development of effective management practices for the Nigerian lakes for fish cultivation and other utilities. (INIS)

14452 (IAEA-R-732-F) DOUBLE ISOTOPE TECHNIQUES FOR THE STUDY OF THE MECHANISMS REGULATING ALDOSTERONE SECRETION AND BIOSYNTHESIS IN EXPERIMENTAL AND CLINICAL CONDITIONS ASSOCIATED WITH HYPERALDOSTERONISM. Final Report for the Period 15 December 1968–14 December 1971. Marusic, E. T. (International Atomic Energy Agency, Vienna (Austria)). May 1971. 3p. INIS.

The basis of the studies carried out was the determination of the conversion rate of corticosterone (B) to aldosterone during incubation of a mitochondrial system in the presence of ^{3}T-labeled corticosterone. After extraction the amount of tracer representing newly synthesized aldosterone was measured. Correction for losses in the extraction procedure was made possible by the addition of trace amounts of ^{14}C-labeled aldosterone before the extraction procedure took place. The adrenal glands were removed from dogs subjected to various experimental conditions such as: sodium depletion; acute angiotensin II and renin infusion of the adrenal glands of hypophysectomized and bilaterally nephrectomized animals; chronic experiments in intact and hypophysectomized animals receiving daily injections of dog renin. Contra-lateral glands provided the controls for individual animals. Glands infused with saline provided control for differences between right and left glands in the measurement of the conversion rate of B to aldosterone. The mitochondrial fraction was obtained by differential centrifugation of adrenal gland homogenates. In the case of chronic experiments, measurement of aldosterone secretion rate was performed by the double radioisotope technique and of cortisol secretion by fluorometry. The results obtained indicate that the acute infusion of adrenal glands with angiotensin II has no effect on the conversion of B to aldosterone in the mitochondrial incubation system. However, it was demonstrated that the prolonged administration of renin causes an increase of the conversion of B to aldosterone in the case of glands from hypophysectomized dogs. This effect is similar to that obtained with sodium depleted animals. (INIS)

14453 (IAEA-R-809-F) APPLICATION OF ISOTOPIC TECHNIQUE IN THE HYDROLOGICAL STUDY OF THE ACONCAGUA RIVER BASIN. Final Report for the Period 1 November 1969–30 November 1972. Alamos Cerda, F. (International Atomic Energy Agency, Vienna (Austria)). Jun 1973. vp. (In Spanish). INIS.

Application of various nuclear techniques was employed in studying the hydrology of the Aconcagua River Valley. The use of ^{131}I in discharge measurements at four selected sections of the river by using the instantaneous injection method enabled the development of discharge rating curves. Twenty discharge measurements covering a range of 0.3 to 50.2 m^3/sec were performed. The directions of groundwater flow were determined by the point dilution method using ^{131}I at selected wells tapping the phreatic alluvium aquifer in the valley. Application of environmental isotope techniques was employed to study the origin and mechanism of recharge to the alluvium aquifer of the valley with particular emphasis on the possible contribution of the river Aconcagua to the adjacent aquifers. (INIS)

14454 (IAEA-R-978-F) ISOTOPE TRACER AIDED STUDIES OF THE EFFECTS OF CHLOROPHENOXY TYPE HERBICIDES IN PLANT TISSUES. Part of a Coordinated Program on the Fate and Significance of Foreign Substances in Food. Final Report for the Period 1 December 1970–30 June 1973. Kovacs, J. (International Atomic Energy Agency, Vienna (Austria)). Mar 1974. vp. INIS.

Preliminary experiments were made to determine the inhibitory effects of the herbicide 2,4,5-T and the analogue 2,4,5-trichlorophenoxyethanol on the growth of the alga Chlamydomonas reinhardti. Growth inhibition by 2,4,5-T was shown at concentrations of 12 ppM of 2,4,5-T at which concentrations no effects of 2,4,5-TE were detected. Residual ^{14}C labeled 2,4,5-T and 2,4,5-trichlorophenoxyethanol were transported mainly through leaf veins. Phosphorus and amino acid metabolism were significantly inhibited by 2,4,5-T only. The effective half-life of ^{14}C labeled 2,4,5-T applied as spray on the surface of the leaves was greater than 3 weeks. On the basis that the chlorophenoxy type herbicides exert their action by either directly or indirectly affecting nucleic acid metabolism techniques were developed for studying the effects of 2,4,5-T and 2,4,5-TE on the rate of DNA repair synthesis following uv irradiation. The rate of DNA repair synthesis was followed by measuring ^{3}H-thymidine incorporation into the DNA in the presence of hydroxyurea. Both 2,4,5-T and 2,4,5-TE inhibited DNA repair synthesis at concentrations of the order of 10^{-3} M. Experiments suggested that the inhibition of DNA repair synthesis is an indirect effect of a reduction of ATP in the presence of the herbicide residue, ATP being essential for DNA repair synthesis. (INIS)

14455 (TID-26691) AUGMENTATION OF MARROW GROWTH BY THYMOCYTES. Pritchard, L. L. (Tennessee Univ., Knoxville (USA)). Jun 1974. 150p. Dep. NTIS $10.50.

Thesis.

Some of the parameters affecting the interaction of thymocytes and marrow cells in hemopoiesis in mice were studied using the uptake of ^{59}Fe by hemopoietic tissues as a tracer to assess the growth of transplanted marrow cells. (CH)

14456 EXAMINATION OF THE LIVER USING RADIO-ACTIVE ROSE BENGAL. Clinical Results of the Dept. of Radioisotopes, H. F. Verwoerd Hospital, Pretoria, 1963–1972. Bieler, E. U.; Jansen, C. R. (Atomic Energy Board, Pelindaba, Pretoria (South Africa). Life Sciences Div.); Meyer, B. J. (Pretoria Univ. (South Africa). Dept. of Physiology). S. Afr. Med. J.; 46: 1772-1781(18 Nov 1972).

Liver scanning, like other studies applying radioactive tracers, is sometimes considered to be of purely academic importance. The purpose of this study was to demonstrate the practical value of liver scanning as a screening examination. (INIS)

14457 DIAGNOSTIC ACCURACY OF THREE TESTS FOR EVALUATING THE THYROID STATUS. Results on the In Vitro Assessment of Thyroid Function and of the 24-Hour ^{131}I Uptake of the Thyroid Gland. Bieler, E. U.; de Bruin, E. J. P. (Atomic Energy Board, Pelindaba, Pretoria (South Africa). Life Sciences Div.); van Rooyen, R. J. (Pretoria Univ. (South Africa). Dept. of Internal Medicine); de Villiers, L. S. (Pretoria Univ. (South Africa). Dept. of Chemical Pathology); Meyer, B. J. (Pretoria Univ. (South Africa). Dept. of Physiology). S. Afr. Med. J.; 47: 266-269(17 Feb 1973).

The results of three tests of thyroid function, obtained from 41 cases of hypothyroidism, 101 persons with normal function of the thyroid gland, and 43 cases of hyperthyroidism are compared. There was a good correlation between two of the tests, viz.: the in vitro estimation of thyroxine by competitive protein-binding assay, and the column chromatography. Their diagnostic accuracy was found to be superior to the 24-hour ^{131}I-uptake measurement in recognizing hypothyroid and euthyroid states of the thyroid gland. (INIS)

14458 THE HALF-LIFE OF ^{131}I-INSULIN IN DIFFERENT GROUPS OF PATIENTS COMPARED WITH NORMAL SUBJECTS. van Rooyen, R. J. (Verwoerd (H. F.) Hospital, Pretoria (South Africa). Dept. of Internal Medicine); de Bruin, E. J. P. (Pretoria Univ. (South Africa)); Bieler, E. U. (Atomic Energy Board, Pelindaba, Pretoria (South Africa). Life Sciences Div.); Hoog, J. M. C. (Pretoria Univ. (South Africa). Dept. of Physiology). S. Afr. Med. J.; 46: 1927-1931(9 Dec 1972).

12 refs.

This study was prompted by the question of whether insulin injected into a patient will affect an insulin assay the following day. The half-life of ^{131}I-insulin in the plasma of diabetic subjects on different treatments was determined and compared with that of normal subjects. Since insulin is rapidly degraded, especially in the liver and kidney, the half-life of intravenously administered ^{131}I-insulin was also determined in subjects with renal or liver insufficiency. Furthermore, ^{131}I-insulin kinetics was studied by whole-body counting, liver and kidney uptake measurements, as well as by blood counts. A prolonged half-life of ^{131}I-insulin was found in diabetics on either crystalline or lente insulin and this probably explains the high insulin values found with radioimmunoassays. An altered relation between exogenous administration of insulin and endogenous disposal of the insulin, as well as an altered relation between free and protein-bound insulin, is probably involved in the aetiology of certain "brittle" states of insulin-treated diabetics. The estimation of the ^{131}I-insulin disappearance time offers a simple means by which the delay in insulin metabolism can be detected. (INIS)

14459 PILOT STUDIES ON THE CLINICAL USE OF THE SHORT-LIVED ISOTOPE FLUORINE-18. Shepstone, B. J.; Blake, K. C. H.; Hering, E. R.; Steyn, J. A. (Groote Schuur Hospital, Cape Town (South Africa). Dept. of Nuclear Medicine; Cape Town Univ. (South Africa); Council for Scientific and Industrial Research, Pretoria (South Africa). National Physical Research Lab.). S. Afr. Med. J.; 47: 1060-1065(23 Jun 1973).

The use of cyclotron-produced ^{18}F at Groote Schuur Hospital is discussed, particularly with regard to the fact that the radionuclide can pick up primary and secondary malignant diseases before they become radiologically manifest. It is therefore suggested that the conventional x-ray skeletal survey be replaced by a ^{18}F whole-body scan or profile, except in the case of carcinoma of the prostate and in the detection of rib metastases, where it has proved disappointing. The method was also found useful for the assessment of bone grafts. (INIS)

14460 BRAIN SCINTIGRAPHY IN THE DIAGNOSIS OF INTRACRANIAL LESIONS. Comparative Scanning with ^{169}Ytterbium Diethylanatriaminepenta-Acetic Acid and ^{203}Mercury Chlormerodrin. Jansen, C. R.; Bieler, E. U. (Atomic Energy Board, Pelindaba, Pretoria (South Africa), Life Sciences Div.); Meyer, B. J. (Pretoria Univ. (South Africa). Dept. of Physiology); du Toit, D. (Verwoerd (H. F.) Hospital, Pretoria (South Africa). Dept. of Diagnostic Radioisotopes). S. Afr. Med. J.; 47: 232-236(10 Feb 1973).

9 refs.

Clinical studies are reported on a recently introduced radiopharmaceutical for brain scanning, which is characterized by a long physical half-life and an extremely rapid biological excretion, thus allowing the application of mCi doses without a potential radiation hazard. Due to the high photon yield, scintigrams are obtained which are comparable to scans obtained with short-living isotopes and which are superior to ^{203}Hg chlormerodrin scans. The long shelf-life makes the use of ^{169}Yb DTPA less expensive than the use of the short-living isotopes and thus makes it ideal for the consumer at a site remote from the radiopharmaceutical manufacturer. It is superior to the short-living isotopes for extended studies like cisternography. The diagnostic accuracy of ^{169}Yb DTPA was found to be superior to ^{203}Hg chlormerodrin in the present series. (INIS)

14461 RADIOACTIVE ISOTOPES USED IN DERMATOLOGIC DIAGNOSIS. Kubickova, V.; Kubicek, M. (Bezirkskrankenhaus Kolin (Czechoslovakia). Haut-Abteilung; Bezirkskrankenhaus Kolin (Czechoslovakia). Radioisotopen-Abteilung). Berufsdermatosen; 22: No. 1, 23-28(Feb 1974). (In German).

4 figs.; 6 refs.

The resorption of radioactive isotopes, and especially of $Na_2{}^{51}CrO_4$ or of labelled components of the skin, was studied in healthy persons and in eczematics who were both sensitized or not, to chromium. The resorption is measured by determining the decrease of the radioactivity. In persons who are sensitized to chromium, the resorption from the skin is accelerated, while it is slowed down in animals exposed several times to chromium. Investigation of the decreases of the activity of radioactive isotopes in the skin is a convenient and reliable method in dermatology. In animals, the sensitivity notion ought to be defined. (auth)

14462 INTEREST OF ^{123}I IN THYROID STUDIES. Piret, L.; Van der Linden, S.; Deutsch, J.; Cogneau, M.; Gillet, R.; Beckers, C. (Louvain Univ., Belg.). Ann. Endocrinol. (Paris); 35: No. 2, 199-203(Mar 1974). (In French).

The first results obtained in thyroid studies performed with ^{123}I produced by the isochrone cyclotron of Louvain-La-Neuve (Belgium) are presented. Thyroid uptake studies have been done in 26 cases, and labeled protein-bound iodine determinations as well. Scintigraphic studies were performed 6 and 24 hrs after giving the tracer. In comparison with the results obtained with the other radionuclides, ^{123}I appears to be very promising especially in pediatrics. (FR)

14463 APPLICATION OF THE RADIOIMMUNOASSAY METHOD TO THE DETERMINATION OF INSULIN IN HUMAN PLASMA. de Toledo e Souza, I. T.; Higa, O. Z.; Wajchenberg, B. L.; Pinto, H.; Pieroni, R. R. Rev. Ass. Med. Brasil.; 20: No. 1, 41-46(Jan 1974). (In Portuguese).

The techniques used for the labelling and purification of ^{125}I-labelled insulin and for the determination of the appropriate antibody dilution are outlined. The method for the determination of the insulin content in a series of plasma samples is given. The characteristics of the operational sequence for the determination of insulin in plasma are evaluated for exactness, specificity, sensitivity, and precision. The results obtained using the methods and techniques described are discussed. (JSR)

14464 DISTRIBUTION AND EXCRETION OF ^{35}S ZIRAM AND METABOLIC PRODUCTS AFTER 24 HOURS FOLLOWING ORAL ADMINISTRATION OF THE PREPARATION IN FEMALE RATS. Izmirova, N. (Obedinen Nauchno-Izsledovatelski Inst. po Khigiena i Okhrana ne Truda, Sofia (Bulgaria)); Marinov, V. (Akademiya na Selskostopanskite Nauki, Sofia (Bulgaria). Tsentralna Lab. po Radiobiologiya). Eksp. Med. Morfol.; 11: No. 3, 152-156(1972). (In Bulgarian).

The distribution, transformation, and excretion of ^{35}S-ziram (zinc-dimethyldithiocarbamate) was examined after 24 hours following oral administration of the preparation in white rats. ^{35}S-ziram was transformed mainly in highly polar compounds dissolved in water. After 24 hours there were considerable amounts of water-soluble metabolites in the thyroid gland, blood, kidneys, spleen, ovaries, and liver. The amount of metabolites, dissolved in chloroform, in the examined organs, was insignificant. The quantitative dependence between the metabolites dissolved in

water and the metabolites dissolved in chloroform was estimated by determining the value of the factor A for various organs and biological fluids. (auth)

14465 CADMIUM AVAILABILITY TO WHEAT: A STUDY WITH RADIOACTIVE TRACERS UNDER FIELD CONDITIONS. Stenstroem, T.; Loensjoe, H. Ambio; 3: No. 2, 87-90(1974).

A micro-plot method useful for studies of long-term variations in cadmium availability and the effect of cultivation practices such as fertilization and liming is presented. The uptake of cadmium from soils and different applications of sewage sludge was determined independently by use of sludge labelled with ^{109}Cd or ^{115m}Cd and by atomic absorption analysis of total cadmium. It is indicated that even a limited use of sludge eventually may give concentrations of cadmium in agricultural products that are intolerable with regard to the WHO recommendations for human intake of cadmium. (auth)

14466 NORMAL VALUES OF T_3 IN BULGARIA, DETERMINED BY MEANS OF RADIOACTIVE ^{131}I-TRIIODTYRONINE. Vlakhov, N.; Dimitrov, A.; Stefanova, N.; Prodanov, V. (Vissh Meditsinski Inst., Plovdiv (Bulgaria)). Folia Med. (Plovdiv); 15: No. 3, 157-159(1973). (In German).

The normal values of T_3 in the blood, determined by means of radioactive ^{131}I-triiodthyronine, are pointed out for the first time in Bulgaria. From investigation of 159 normal persons it was established that T_3 in men is within the limits of 15.8 to 22.1% and in women from 16.2 to 23.2%. Conclusions were drawn about the convenience of the test, having in mind the simplicity of technical performance and lack of radioactivity commutation in the patient. (auth)

14467 A STUDY ON THE WATER- AND CHLOROFORM-SOLUBLE METABOLITES OF ^{35}S-ZIRAM BY MEANS OF PAPER AND THIN-LAYER-CHROMATOGRAPHY. Izmirova, N. (Obedinen Nauchno-Izsledovatelski Inst. po Khigiena i Okhrana na Truda, Sofia (Bulgaria)). Eksp. Med. Morfol.; 11: No. 4, 240-243(1972). (In Bulgarian).

Ziram (zinc dimethyl carbamate) metabolizes quickly in white rats after oral administration. In the stomach content of a rat 24 hours after its administration there were 6 sulfur-containing chloroform soluble compounds, 10% of which were determined as ziram. The amount of undivided ziram in feces is 57% of the total amount of chloroform soluble S-metabolites found in feces. There are five ^{35}S-labelled metabolic products in urine. The largest is the amount of the metabolite I with Rf 0.33 to 173.2 imp/min (74.34% of the total amount of water soluble ^{35}S-labelled compounds, excreted in urine). Three of these metabolites with Rf 0.33; 0.44, and 0.53 were found in all of the examined samples. (auth)

14468 INCORPORATION OF C^{14}-PYRUVATE AND C^{14}-KETOGLUTARATE IN ALANINE AND GLUTAMIC ACID IN ISOLATED CHLOROPLASTS. Tsenova, E. N.; Vaklinova, S. G. (Bylgarska Akademiya na Naukite, Sofia). Compt. Rend. Acad. Bulg. Sci.; 27: No. 1, 97-100(1974).

Experiments were carried out in order to obtain direct evidence for the fact that in isolated chloroplasts the ^{14}C-pyruvate and the ^{14}C-ketoglutarate are actually used as immediate precursors of the alanine and glutamic acid. ^{14}C-pyruvate is incorporated in alcohol-soluble compounds of the chloroplasts, the incorporation rising with prolongation of the exposure time, introduction of exogenously NH_4^+ and when incubation is done in light. ^{14}C-pyruvate undergoes reductive aminations and as a result ^{14}C-alanine is formed. This synthesis is matched with the synthesis of labelled glutamic acid. ^{14}C-ketoglutarate is included in the alcohol soluble compounds of the chloroplasts as early as the 5th minute. The radioactivity of the glutamic acid increases with increase of the exposure time under condition of illumination and when NH_4^+ is added, but ^{14}C-glutamic acid is formed also without any addition of ammonium. No labelled alanine was discovered in these samples. (INIS)

14469 ON SOME PROBLEMS OF MINARAL METABOLISM IN DOMESTIC BIRDS. Ermenkov, K. Nauch. Tr., Vissh Selskostop. Inst., Sofia.; 23: 557-568(1973). (In Bulgarian).

The metabolism of Ca and Zn in birds was studied. In comparison with Zn, the resorption of Ca is effected considerably faster. The maximum resorption of ^{45}Ca is accomplished during the first 60 minutes while the resorption of ^{65}Zn towards the 120th minute. The basic mass of muscle introduced ^{45}Ca is eliminated through the kidneys (70.4%) and a smaller part with the feces (29.6%). In the case of ^{65}Zn an opposite picture was observed: an insignificant quantity (0.82%) is eliminated with the urine and a much larger one of the isotope with the feces (14.33%). The faecal calcium in birds is supplied chiefly by its excretion with the bile, while the faecal zinc has its main origin in the zinc included in the pancreatic juice. The inclusion of zinc in eggs in effected chiefly in the yolk. For 60 days hens eliminate with the yolk of the eggs laid by them 28 to 34% of the introduced ^{65}Zn. (auth)

14470 ON THE METABOLISM OF ZINC IN THE ORGANISM OF BIRDS. IV. The Inclusion of Zn^{65} in the Eggs of Laying Hens. Ermenkov, K. Nauch. Tr., Vissh Selskostop. Inst., Sofia.; 23: 579-590(1973). (In Bulgarian).

The dynamics of ^{65}Zn evolvement with the various egg constituents (shell, protein, yolk), the inclusion of the isotope in the protein and non-protein fractions of the egg yolk, and its distribution in laying hens was studied in a continuous experiment (30 and 60 days). The inclusion of ^{65}Zn in the eggs is effected chiefly in the yolk; only traces have been detected in the protein and almost nothing in the shell. The elimination of ^{65}Zn with the eggs starts on the day following introduction of the isotope and reaches its maximum between the 3rd and the 10th day. The largest amount of radioactive Zn is eliminated with the 8th egg after which the evolvement gradually decreases. For 60 days the hens eliminate with the eggs laid by them 26 to 33% of the introduced ^{65}Zn. The largest radioactivity was observed in the liver, the breast bone, the pancreas, the womb and the lungs and comparatively the smallest in the protein part of the oviduct, the pre-neck of the oviduct, the cerebrum, and the muscles. The womb contains about three times more ^{65}Zn in comparison with the pre-neck and the protein fraction of the oviduct. (auth)

14471 THE ACTIVITY OF VARIOUS VITAMIN B_{12} DOSES ON THE METABOLISM OF Ca^{45} AND P^{32} IN CHICKENS. Ermenkov, K.; Stanchev, Kh. Nauch. Tr., Vissh Selskostop. Inst., Sofia.; 23: 615-625(1973). (In Bulgarian).

Investigations show that the addition of 10, 20, and 30 gama vitamin B_{12} per kg food lowers the content of common and radioactive calcium in the bones of the experimental chickens. The differences between the experimental and the control groups, however, are not reliable statistically. The opposite effect was observed in regards to the organs, accumulation of larger quantities of ^{45}Ca in the liver, the muscles, and the kidneys. This shows that, at 500 UI vitamin D_3, the addition of 10, 20, and 30 gama vitamin B_{12} per kg food does not alter substantially the metabolsim of calcium but affects its distribution among separate organs and tissues. The doses of vitamin B_{12} used in the food of chickens do not alter the common phosphorus quantity in the bone tissue. More characteristic changes appear in the accumulation and the metabolism of ^{32}P. The largest inclusion of ^{32}P is effected in the bones of chickens receiving 10 gama vitamin B_{12} per kg food. The addition of 20 and 30 gama affects positively the inclusion of ^{32}P in the liver, the muscles, and the kidneys. (auth)

14472 INTRODUCTION OF ^{35}S-METHIONINE IN THE PROTEIN FRACTION OF THE PANCREATIC JUICE, THE BILE AND THE BLOOD SERUM OF BIRDS. Gotev, R.; Ivanov, Ts. Nauch. Tr., Vissh Selskostop. Inst., Sofia.; 23: 591-601(1973). (In Bulgarian).

The dynamics of including ^{35}S-methionine and the degree of its incorporation in the protein fractions in electrophoretic division and radioautographing of the photograms of blood serum, the pancreatic juice and bile, collected by chronic fistules, were investigated. The radioactivity of native digesting-juices and of the blood serum is high during the first 12 hours of the muscle introduction of radiomethionine. In the bile the maximum is at the 3rd hour, in pancreatic juice at the 4th, while the radioactivity of the blood serum is comparatively high and constant between the 2nd and the 12th hours. The highest inclusion of radioactive methionine was observed in the bile and the lowest in the pancreatic juice. In recording relative percentage of distribution of the isotope in the fractions, it was established that in the bile the radiomethionine is included at the beginning of the beta-globulins and in the lipoprotein fraction and later basically in the beta-globulins. In the pancreatic juice the incorporation is chiefly in the fractions corresponding to the alpha-globulins of the blood serum. The radioactivity of the blood serum in the fractions is the same. (auth)

14473 COMPARATIVE CHARACTERISTICS OF THE PHOTOSYNTHETIC ACTIVITY AND ^{14}C DISTRIBUTION OF SOME PLANT SPECIES, CULTIVATED IN GREENHOUSE CONDITIONS. Jordanov, I. Izv. Inst. Fiziol. Rast., Bulg. Akad. Nauk.; 18: 205-215(1973). (In Bulgarian).

The photosynthetic activity and distribution of the assimilated carbon in the photosynthesis process were investigated between alcoholic, perchloric acid, and alkaline fractions of 10 plant species, cultivated in greenhouse conditions. The selected representatives include near-related and far-related varieties

in systematical relation, some of which differ also from their metabolism type. In the investigated species the photosynthesis intensity varies in large limits, from 10.6 (by begonia) to 39.0 mg $CO_2/dm^2/h$ at spinach and radishes. The photosynthetic activity of the other varieties is between 20 and 30 mg $CO_2/cm^2/h$. The ^{14}C distribution in the different fractions of some species is quite close regardless of the fact that they belong to different genera and families. Among the investigated species the distribution in fractions is sharply outlined by pelargonium. While in other species the greatest ^{14}C part is in the alcoholic fraction for pelargonium the maximum radioactivity is concentrated in the perchloric acid fraction. For begonia the radioactivity of this fraction is also considerable. By comparing the light curves of the comparatively photo-phylous variety (radishes) with the light curves of the shade-phylous variety (asarum) it is found that at low light intensities the photosynthetic activity of the more photo-phylous variety decreases more considerably than the photosynthetic activity of the shade-phylous variety. Moreover the light intensity where the exposition is carried out exerts an essential influence on ^{14}C distribution. Data confirm the idea that the metabolic nature of the photosynthetic products is determined mainly from the hereditary features of the same plant, but not from its systematic situation. (auth)

14474 RENAL Hg UPTAKE MEASUREMENT BY QUANTITATIVE SCINTIGRAPHY USING A SCINTIGRAPH. Raynaud, C.; Knipper, M. (CEA, Paris). pp 16-25 of Renal Uptake of $^{197}HgCl_2$. Raynaud, C. (comp.). Paris; Masson (1973). (In French).

$^{197}HgCl_2$ is injected under conditions similar to those of the external counting measurement technique. The data obtained during renal scintigraphy are stored after coding in the memory of a multi-channel analyser and the renal fixation is calculated by integrating the activity of the two kidney zones. In this way it is possible to calculate the fixation rate while looking at the image and the examination time can be reduced to the time occupied by scanning and digital analysis of the scintigram. This method lies midway between the external counting technique, inexpensive but relatively time-consuming, and the gamma camera technique, fast but requiring elaborate equipment. (FR)

14475 GAMMA CAMERA MEASUREMENT OF MERCURY UPTAKE BY THE KIDNEY. Schoutens, A. (Hopital Universitaire, Brussels); Paternot, J.; Erbsmann, F. pp 26-45 of Renal Uptake of $^{197}HgCl_2$. Raynaud, C. (comp.). Paris; Masson (1973). (In French).

After 300 μCi of $^{197}HgCl_2$ were injected into the patient fixation measurements were performed on the 2nd and 3rd days. The technique is described. The gamma camera gives an accurate visual image of the regions concerned and provides digital information, which facilitates automation of the intermediate computing stages. This digital information is sent either to a multichannel analyzer or directly to a computer. The technique offers the enormous advantage of working on a graphical representation of the radioactivity distributions, but the usual difficulties arise in connection with demarcation, renal depth determination, and correction of the right kidney for liver overlap. These difficulties are analyzed. The gamma camera method of measuring renal Hg fixation is nevertheless considered promising because of its theoretical possibilities. (FR)

14476 SOLID-PHASE RADIOIMMUNOASSAY OF RAT SKIN COLLAGENASE. Comparative Studies and in Vivo Measurement of the Enzyme. Eisen, A. Z.; Nepute, J.; Stricklin, G. P.; Bauer, E. A.; Jeffrey, J. J. (Washington Univ., St. Louis, Mo. (USA). School of Medicine). Biochim. Biophys. Acta; 350: No. 2, 442-454(Jun 1974).

Solid-phase radioimmunoassay for the measurement of collagenase in rat skin determines 0.3 to 20 ng of enzyme. The immunoassay is at least 1000 times more sensitive than the enzymatic assay. The similarities between rat skin and rat uterus collagenases, as well as collagenases from a variety of other animal sources, were evaluated by assessing their relative binding capabilities in the solid-phase radioimmunoassay. Rat uterus collagenase was found to be identical in its cross-reactivity with rat skin collagenase in the immunoassay indicating that these rat collagenases are structurally closely related. The cross-reactivity between the collagenase from mouse skin and rat skin collagenase was one of complete immunologic identity although this was not the case for the skin collagenase from another rodent, the guinea pig. This indicates that the solid-phase radioimmunoassay can be used to measure collagenase levels in mouse skin and perhaps other mouse tissues as well. Collagenases from phylogenetically more distant species cross-react much less strongly, suggesting the existence of fewer similarities to the rat enzymes. Quantitative determination of collagenase in rat skin using the solid-phase radioimmunoassay indicates that the enzyme content reaches a maximum during the first 24 h after birth and by one week of age has declined to a level found in the mature animal. (INIS)

14477 THE DETERMINATION OF LEFT-TO-RIGHT CARDIAC SHUNTS BY GAMMA SCINTIGRAPHY. van Aswegen, A.; Loetter, M. G.; Minnaar, P. C. (University of the Orange Free State, Bloemfontein (South Africa). Dept. of Biophysics); Kleynhans, P. H. T. (University of the Orange Free State, Bloemfontein (South Africa) Dept. of Internal Medicine). S. Afr. Med. J.; 47: 1700-1704(Sep 1973). (In Afrikaans).

Left-to-right cardiac shunts can be easily detected by performing a dynamic scintigraphic study with an Anger camera and ^{99m}Tc. The method is based on the analysis of pulmonary vascular radioisotope dilution curves. The technique of the examination, analysis of data, as well as pitfalls experienced during the examination, will be mentioned. (INIS)

14478 USE OF TECHNETIUM IN THE DIFFERENTIAL DIAGNOSIS BETWEEN SUBACUTE THYROIDITIS AND OTHER THYROID DISEASES. Spindel, A.; Diengott, D. (Rothschild Municipal-Government Hospital, Haifa, Israel). Israel J. Med. Sci.; 10: No. 11, 1410-1414(Nov 1974).

In patients with subacute thyroiditis, exogenous iodine intake or hypothyroidism from various causes, thyroid scans were performed after intravenous administration of 1 mCi technetium-99m as pertechnetate. Simultaneous ^{131}I uptake and scans were performed. This method was particularly useful in distinguishing between subacute thyroiditis and exogenous iodine intake. Visualization of the thyroid gland, even at low levels of functional thyroid tissue, was feasible because of the high photon yield obtained from the larger dose of the short-lived isotope. (auth)

14479 LIVER SCANNING. Poulose, K. P. (Medical Coll., Trivandrum, India). Antiseptic; 70: No. 5, 297-302(1973).

The principle of liver scanning and the various radiopharmaceuticals used for tests are described. The indications for, advantages of, and limitations to the liver scanning technique are evaluated. (Indian Sci. Abstr.)

14480 MEASUREMENT OF REGIONAL MYOCARDIAL CIRCULATION IN MAN. Slany, J.; Moesslacher, H.; Dorau, F.; Imhof, H.; Umek, H. (Univ., Vienna). Z. Kardiol.; 62: No. 11, 989-998(Nov 1973). (In German).

A method is presented to measure regional blood flow in man by evaluation of local clearance rates of xenon-133 injected selectively into the left coronary artery by means of an Anger scintillation camera. 15 patients were investigated. In 9 patients without coronary artery disease, demonstrated by coronary arteriography, differences of regional myocardial blood flow were measured with a standard deviation of ±10.2 ml/100 g/min from total left ventricular myocardial blood flow. Results were similar in 3 patients with severe coronary artery stenosis. Regional reduction of myocardial flow rates in accordance to the site of coronary artery stenosis was observed further in 3 cases. (auth)

14481 SENSITIVE AND PRECISE METHOD FOR ESTIMATION OF FREE THYROXINE IN SERUM AS A THYROID FUNCTION TEST USING L-THYROXINE-^{125}I. Abdel-Wahab, M. F.; Megahed, Y. M. (Atomic Energy Establishment, Cairo). Isotopenpraxis; 10: No. 7, 255-258(Jul 1974).

A method for free thyroxine estimation in serum, using labelled thyroxine and Sephadex G-25 was developed. The experiment was carried out by incubating labelled thyroxine with serum samples and separating the free thyroxine from bound protein in the serum by gel filtration after complete equilibrium between exogenous and endogenous thyroxine. Factors affecting the free thyroxine ratio such as volume of serum used, concentration of labelled thyroxine, time, and temperature of incubation were studied and the optimum conditions for the test were selected. The sensitivity of the technique was determined by carrying out twelve estimations of the free thyroxine ratio on samples of pooled normal serum, pooled hypothyroid serum, and pooled hyperthyroid serum. In addition free thyroxine ratio was determined for 23 hypothyroidisms, 99 euthyroid patients, 40 untreated thyrotoxicosis, and 50 normal serum samples. A good correlation with the thyroid status of the patients (as determined) clinically and with radioiodine techniques was observed. (auth)

14482 STUDIES ON THE DETERMINATION OF SOMATOTROPIN IN BOVINE PLASMA WITH A RADIOIMMUNOLOGICAL METHOD. Part 1. Labelling of the Hormone. Stelmasiak, T. (Polska Akademia Nauk, Jastrzebiec. Instytut Genetyki i Hodowli Zwierzat). Biul., Inst. Genet. Hodowli Zwierzat; 25: 57-67(1972).

A method is presented for the isolation of an immunologically active bovine growth hormone labelled with ^{131}I. An isotope preparation produced in the Institute for Nuclear Research in

Swierk was used in these studies. A preliminary purification of the labelled preparation was performed using chromatography on Sephadex G-25. Thereafter, for more extensive purification, electrophoresis on starch gel was employed. The labelled preparation preserved its immunological properties for about 93%. (auth)

14483 STUDIES ON THE DETERMINATION OF SOMATOTROPIN IN BOVINE PLASMA WITH A RADIOIMMUNOLOGICAL METHOD. Part 2. The Radioimmunological Test. Stelmasiak, T. (Polska Akademia Nauk, Jastrzebiec. Instytut Genetyki i Hodowli Zwierzat). Biul., Inst. Genet. Hodowli Zwierzat; 26: 51-64(1972).

A radioimmunological method for determination of somatotropin in bovine plasma is presented. The labelled hormone used for the assay had a specific radioactivity of about 400 μCi/μg and the immunological properties preserved for 93%. The antibodies against somatotropin were obtained by immunizing the rabbits, and those against rabbit γ-globulin by immunizing the guinea pigs. A "double-antibody" technique was employed for separating the free hormone from the hormone-antibody complex. The described radioimmunological assay exhibits a sensitivity of the order of 10^{-9} g/ml and a specificity 96.4% ± 13.2. (auth)

14484 STUDIES ON THE DETERMINATION OF SOMATOTROPIN IN BOVINE PLASMA WITH A RADIOIMMUNOLOGICAL METHOD. Part 3. Plasma Levels of the Hormone in Jersey and Charolais Bullocks as Affected by Age. Stelmasiak, T. (Polska Akademia Nauk, Jastrzebiec. Instytut Genetyki i Hodowli Zwierzat). Biul., Inst. Genet. Hodowli Zwierzat; 27: 45-52(1972).

Investigations were carried out on somatotropin level in plasma of 32 bullocks of Jersey and Charolais breeds. Animals divided into 4 groups according to age (2, 4, 8, and 16 months) were maintained and fed in the same way. No inter-breed differences in the GH plasma level were observed; this level, however decreased markedly with age. The eventual interbreed differences are assumed to involve the genetically controlled different tissue response to the hormone. (auth)

14485 KIDNEY CLEARANCE OF NUCLEAR PHARMACEUTICAL LABELLED WITH RADIOMERCURY. II. The Dependence of the Organ Kinetics on the Chemical Constitution. Herzmann, H.; Schwartz, K. D.; Flentje, H.; Herzmann, A.; Holldorf, M.; Schmidt, H. E. (Zentralinstitut fuer Isotopen-und Strahlenforschung, Berlin). Isotopenpraxis; 10: No. 7, 249-254(Jul 1974). (In German).

A number of new ^{203}Hg-labelled compounds were prepared from the nuclear pharmaceuticals neohydrin and mersalyl and were pharmacological and partially clinically tested. The compounds were aliphatic, carbocyclic, and heterocyclic compounds. In most compounds there was a close relation between the chemical composition and the organ kinetics. The rate of accumulation and elimination was affected as expected primarily by the reactive groups of the compounds. Six compounds were found with better kinetic properties than chlomerodrin. These have however, to various degrees, the disadvantage of a biphase elimination. The results of analogous studies on compounds in which the Hg is bound directly to the ring were reported elsewhere. (tr-auth)

14486 GLUCOSE METABOLISM IN NEISSERIA GONORRHOEAE. Morse, S. A.; Stein, S.; Hines, J. (Harvard School of Public Health, Boston). J. Bacteriol.; 120: No. 2, 702-714 (Nov 1974).

The metabolism of glucose was examined in several clinical isolates of Neisseria gonorrhoeae. Radiorespirometric studies revealed that growing cells metabolized glucose by a combination on the Entner-Doudoroff and pentose phosphate pathways. A portion of the glyceraldehyde-3-phosphate formed via the Entner-Doudoroff pathway was recycled by conversion to glucose-6-phosphate. Subsequent catabolism of this glucose-6-phosphate by either the Entner-Doudoroff or pentose phosphate pathways yielded CO_2 from the original C6 of glucose. Enzyme analyses confirmed the presence of all enzymes of the Entner-Doudoroff, pentose phosphate, and Embden-Meyerhof-Parnas pathways. There was always a high specific activity of glucose-6-phosphate dehydrogenase (EC 1.1.1.49) relative to that of 6-phosphogluconate dehydrogenase (EC 1.1.1.44). The glucose-6-phosphate dehydrogenase utilized either nicotinamide adenine dinucleotide phosphate or nicotinamide adenine dinucleotide as electron acceptor. Acetate was the only detectable nongaseous end product of glucose metabolism. Following the disappearance of glucose, acetate was metabolized by the tricarboxylic acid cycle as evidenced by the preferential oxidation of [1-^{14}C]acetate over that of [2-^{14}C]acetate. When an aerobically grown log-phase culture was subjected to anaerobic conditions, lactate and acetate were formed from glucose. Radiorespirometric studies showed that under these conditions, glucose was dissimilated entirely by the Entner-Doudoroff pathway. Further studies determined that this anaerobic dissimilation of glucose was not growth dependent. (auth)

14487 PHOTOREACTIVATION, PHOTOPRODUCT FORMATION, AND DEOXYRIBONUCLEIC ACID STATE IN ULTRAVIOLET-IRRADIATED SPORULATING CULTURES OF BACILLUS CEREUS. Baillie, E.; Germaine, G. R.; Murrell, W. G.; Ohye, D. F. (Commonwealth Scientific and Industrial Research Organization, North Ryde, Australia). J. Bacteriol.; 120: No. 1, 516-523(Oct 1974).

Photoreactivation of ultraviolet-irradiated Bacillus cereus T declined markedly during the development of stage IV forespores. During ultraviolet irradiation of a culture containing early and late stage IV forespores, both vegetative- and spore-type photoproducts were formed. The formation of vegetative-type photoproducts (mainly thymine dimers) decreased to nearly half during late stage IV, remaining constant until lysis of the mother cells began, when it fell to zero. Spore-type photoproducts were first observed during late stage IV and increased with the increase in numbers of late stage IV forespores. The occurrence of spore-type photoproducts preceded the development of refractile forespores by about 1 h. At stage III the nuclear material occupied a central position, and the ribosomes were at the periphery of the forespore protoplast. During stage IV the deoxyribonucleic acid (DNA) occurred in a peripheral position, and bundles of fibers ("transition" DNA) could be seen. By stage V, all of the DNA appeared to be of the spore type and was peripheral, and the forespore protoplast center was packed with ribosomes. Forespore stages II, III, and IV were classified by light and electron microscopy. The curve for electron microscope classifications preceded that for light microscope classifications by approximately one stage. The formation of spore-type photoproducts preceded differentiation of DNA by about 1 h, the latter coinciding with the development of refractility. Spore-type photoproducts have been associated with DNA in the A state, and the progressive change of the forespore DNA into this state is discussed in relation to the spore differentiation process. (auth)

14488 SIMPLIFIED RADIOIMMUNOASSAY FOR PLASMA ALDOSTERONE EMPLOYING AN ANTIBODY OF UNIQUE SPECIFICITY. Poulsen, K. (Massachusetts General Hospital, Boston); Sancho, J.; Haber, E. Clin. Immunol. Immunopathol.; 2: 373-380(1974).

A highly selective antibody for aldosterone was utilized as the basis for a radioimmunoassay for aldosterone in plasma, which did not require fractionation of this compound from other steroids. No appreciable cross reactivity was found with any steroid tested except 18-hydroxy-11-deoxycorticosterone and 18-OH-corticosterone, but the affinity for these compounds was four orders of magnitude lower than for aldosterone. Specificity was further documented by demonstrating undetectable aldosterone levels in adrenalectomized dogs and suppression of measured aldosterone levels to 0 in a dog subjected to Na loading and a course of deoxycorticosterone. Immunologic identity of standards and plasma aldosterone was demonstrated by showing that dilutions of a human plasma containing a high concentration of aldosterone paralleled a standard curve. Sensitivity, recovery, and accuracy of the method were tested and found satisfactory. Good correlation of results with a method employing chromatographic isolation of aldosterone was demonstrated. Aldosterone plasma values in normal human subjects in response to changes in posture and Na intake, as measured by this method, correlated in the expected fashion with changes in renin activity but did not correlate with plasma cortisol, which followed the anticipated diurnal cycle. (auth)

14489 RAPID AND SIMPLE RADIOASSAY FOR THYMINE 7-HYDROXYLASE. Liu, T. Z.; Wong, C. H.; Shohet, S. B. (Univ. of California, San Francisco). Anal. Biochem.; 62: No. 2, 408-416(Dec 1974).

This work describes a simple and convenient procedure for measuring the activity of thymine 7-hydroxylase. The principle of the procedure depends upon the conversion of tritiated thymine by the enzyme to 5-hydroxymethyluracil. This reacion simultaneously invokes the loss of a tritium atom and the formation of tritiated water. The quantity of tritiated water formed is stoichiometrically proportional to the amount of 5-hydroxymethyluracil produced. The sensitivity of this procedure was markedly improved when both catalase and bovine serum albumin were included in the reaction mixture. (auth)

14490 TECHNICAL CONSIDERATIONS IN LABELING OF BLOOD ELEMENTS. Eckelman, W. C. (Washington Hospital Center, Washington, DC). Semin. Nucl. Med.; 5: No. 1, 3-10 (Jan 1975).

The technical difficulties of labeling albumin, red blood cells, white blood cells, and platelets are discussed with respect to the

effect of procedural differences on the in vivo fate of the radiolabeled blood element. Albumin can be labeled with ^{99m}Tc by a variety of procedures not proved clinically. The labeling of erythrocytes with ^{51}Cr is well defined, but the demand for a better radionuclide has not led to a routine procedure for ^{99m}Tc-labeled red blood cells. The procedure for labeling white blood cells and platelets with ^{51}Cr has been established, but the in vivo viability of the cells remains in question. Labeling techniques with other isotopes such as ^{67}Ga and ^{99m}Tc are still being developed. Blood elements labeled with ^{51}Cr are by far the best defined species, but much remains to be done with isotopes having better physical properties. (auth)

14491 STUDIES OF THE ERYTHRON. Pollycove, M.; Tono, M. (San Francisco General Hospital). Semin. Nucl. Med.; 5: No. 1, 11-61(Jan 1975).

Radionuclide studies of the erythron are valuable to the physician in evaluating the clinical situation in a wide variety of hematologic disorders. A complete and accurate analysis of the life cycle of the red cell can be obtained with a full iron kinetic study, in conjunction with a DF^{32}P red-cell survival study. However, a complete iron kinetic study is not always necessary. It may be abbreviated by deleting the in vitro phase of the iron kinetic procedure. The abbreviated iron kinetic study is also done in conjunction with a DF^{32}P red-cell survival study. It can easily be performed by injecting ^{59}Fe-labeled plasma and monitoring externally over the spleen, liver, and sacrum. Measurements of red-cell survival may be obtained with either ^{51}Cr or DF^{32}P. Although ^{51}Cr provides a relatively uniform label of circulating red cells and is convenient to count in vitro, its highly variable elution rate precludes an accurate measurement of erythrocyte survival. The ^{51}Cr method provides only a rough index of circulating red-cell half-times as a measure of red-cell survival. DF^{32}P, however, is a permanent label of circulating red cells. It provides a direct measurement of erythrocyte survival and permits in vivo labeling of red cells simply by means of direct intravenous injection. Because it has an elution rate that is virtually zero after minimal elution on the day of injection, and because it is not reutilized, DF^{32}P is unquestionably the best agent known for the determination of red-cell survival. In addition to these diagnostic data, the complete iron kinetic study can provide data on the deposition of iron in storage and the rate of iron storage exchange. It can also determine if erythropoiesis is quantitatively abnormal and if the abnormality is located in the bone marrow or in other organs such as the liver or spleen. Although the study of hematologic disorders is one of the most rapidly developing areas of medical research, techniques that are currently available can provide an understanding of the life cycle of the red cell and valuable data that can be applied directly to the clinical situation. When performed accurately, these studies provide a thorough analysis of the pathophysiology of the erythron and are valuable clinical tools that can be used successfully in the diagnosis and evaluation of a broad spectrum of hematological disorders. (auth)

14492 RADIONUCLIDE STUDIES IN THE HODGKIN'S DISEASE AND LYMPHOMAS. Richman, S. D.; Levenson, S. M.; Jones, A. E.; Johnston, G. S. (National Institutes of Health, Bethesda, MD). Semin. Nucl. Med.; 5: No. 1, 103-118(Jan 1975).

A rational, multidisciplinary approach to Hodgkin's disease and the non-Hodgkin's lymphomas has been responsible for major advances in therapy. Invasive diagnostic procedures and exploratory laparotomy, with their associated complications, make nontraumatic radionuclide imaging most appealing in both the clinical staging of disease and in evaluating therapy. Gallium-67-citrate, the tumor scanning agent of the early 1970s, has demonstrated a marked affinity for Hodgkin's disease and the other lymphomas. False positives are few, with sensitivity greater than 70% throughout the spectrum of Hodgkin's disease and the histiocytic lymphomas. In addition to confirming sites of suspected neoplasm, this agent has proved useful in the detection of occult involvement. Moreover, resolution of abnormal gallium-67 concentrations on follow-up studies functions as a visual ancillary index of therapeutic response. The value of whole-body gallium-67 scintigraphy is further enhanced when used in conjunction with routine technetium brain, bone, liver, and spleen scans. While the diagnostic accuracy of gallium-67 studies has been limited in the abdomen due to bowel activity, our attempts to improve these results with the tumor-seeking radiopharmaceutical indium-111-Bleomycin were unrewarding and subsequently were discontinued. Finally, radionuclide lymphography has also been explored. Its diagnostic usefulness in detecting pelvic and abdominal lymph node involvement warrants further investigation. (auth)

14493 USE OF RADIOISOTOPE TECHNIQUES IN THE CLINICAL EVALUATION OF PATIENTS WITH MEGALOBLASTIC ANEMIA. McIntyre, P. A. (Johns Hopkins Medical Inst., Baltimore). Semin. Nucl. Med.; 5: No. 1, 79-94(Jan 1975).

Because virtually all cases of vitamin B_{12} deficiency seen in this country are due to malabsorption, the availability of radioactive vitamin B_{12} for direct measurement of absorption of this essential nutrient has proved to be of great clinical value. These tests are useful not only in demonstrating vitamin B_{12} malabsorption but also often in defining the pathophysiological mechanism responsible for this abnormality. The urinary excretion test of Schilling remains the most useful test for vitamin B_{12} absorption. Minor precautions and modifications in technique make the test results more reliable and easier to interpret. The 8-hr plasma test for vitamin B_{12} absorption can no longer be considered acceptable. Some patients with vitamin B_{12} malabsorption have results in the normal range when studied by this method. Serum vitamin B_{12} assays utilizing radioactive vitamin B_{12} and the isotope dilution principle are now widely used and are useful screening tests. Low normal or borderline results observed in patients with clinical evidence suggestive of vitamin B_{12} deficiency should be interpreted with caution or confirmed by radioactive vitamin B_{12} absorption studies. Radioactive vitamin B_{12} can also be used for rapid, reliable assay of gastric intrinsic factor, antibody to intrinsic factor, and unsaturated vitamin B_{12} serum binding capacity. Methods using radioactive folate compounds for similar in vivo and in vitro studies are not yet applicable for routine use in nuclear medicine laboratories. (auth)

14494 BLOOD VOLUME. Wright, R. R.; Tono, M.; Pollycove, M. (San Francisco General Hospital). Semin. Nucl. Med.; 5: No. 1, 63-78(Jan 1975).

During the past decade the diagnostic use of blood volume determinations has declined as a result of the generation of largely inaccurate results and inappropriate normalization and interpretation. After historical development of more than 50 years, current methodology employs ^{125}I-labeled human serum albumin and ^{51}Cr-labeled red blood cells to determine plasma volume and red cell volume, respectively. Accurate blood volume determinations require (1) abandoning the use of the mean body hematocrit : venous hematocrit ratio and using simultaneous independent measurements of both volumes; (2) delaying multiple postinjection patient samples until complete mixing and equilibration are complete; (3) back-extrapolation of plasma concentrations of ^{125}I to account for albumin loss from the plasma, and rarely, back-extrapolation of red cell concentrations to account for dilution by red cells transfused during the procedure; (4) normalization of volumes by adjusting patient weight to normal correspondence with lean tissue mass, whenever necessary. A rapid, routine method that fulfills these four requirements is presented. A number of surgical and medical conditions in which blood volume determinations are very useful in diagnosis and therapy are discussed. Recently developed techniques for blood volume measurements include neutron activation analysis and fluorescent excitation analysis. Correct normalization of accurate blood volume measurements will provide a valuable service to the entire medical community. (auth)

14495 RADIOIMMUNOASSAY OF PLASMA ESTRADIOL WITHOUT EXTRACTION AND CHROMATOGRAPHY. Jurjens, H.; Pratt, J. J.; Woldring, M. G. (Academy Zickenhuis, Groningen, Netherlands). J. Clin. Endocrinol. Metab.; 40: No. 1, 19-25(Jan 1975).

A method for the radioimmunoassay of plasma estradiol is described, which does not require extraction and chromatography of the plasma estradiol. Antibodies to estradiol-6(0-carboxymethyl) oxime coupled to bovine serum albumin are used. Interference from binding proteins normally present in human plasma is removed by adding a gross excess of testosterone to each sample, thereby displacing estradiol from all binding proteins except perhaps albumin which binds only weakly. Separation of bound and free ^{3}H-estradiol is by means of active charcoal. Plasma proteins interfere with the separation step but this interference can be corrected for. Because there is no extraction or chromatography, recovery of plasma estradiol is always 100%. Because the procedure for correction of plasma protein interference makes the standard curve and sample directly comparable, the blank is automatically zero. Data indicating the accuracy of the method are presented. Data concerning the specificity of the antisera are given and the limitations in the use of these antisera are discussed. (auth)

14496 ASSAY AND REGULATION OF S-ADENOSYLMETHIONINE SYNTHETASE IN SACCHAROMYCES CEREVISIAE AND CANDIDA UTILIS. Holcomb, E.; Shapiro, S. K. (Univ. of Illinois, Chicago). J. Bacteriol.; 121: No. 1, 267-271(Jan 1975).

A simple and sensitive assay for S-adenosylmethionine (SAM) synthetase is described, which depends on the quantitative separation of the product, [$^{14}CH_3$]S-adenosylmethionine, from the substrate, L-[$^{14}CH_3$]methionine, on a Bio-Rex 70 column. L-Methionine protects the enzyme during preparation of cell extracts by sonic treatment but causes repression of enzyme activity during growth of Candida utilis. The presence of 5 mM methionine in the growth

medium repressed SAM synthetase specific activity threefold compared to the specific activity of the enzyme isolated from cells grown in unsupplemented medium. Conversely, the presence of methionine in the growth medium resulted in an 80-fold increase in the intracellular concentration of SAM as compared to the SAM accumulated intracellularly in unsupplemented cultures. (auth)

14497 CRITERIA FOR PREPARING, EVALUATING, AND STANDARDIZING IODINATED GLOBULINS FOR RADIOIMMUNOASSAY PROCEDURES. Hutchinson, H. D.; Ziegler, D. W. (Center for Disease Control, Atlanta). Appl. Microbiol.; 28: No. 6, 935-942(Dec 1974).

Procedures were examined for labeling immune globulins with radioactive iodine using chloramine-T as the oxidizing agent. The chloramine-T method was critically evaluated to establish the optimal conditions for preparing iodinated globulins with high specific radioactivities without impairing their immunospecificities for use in in vitro radioimmunoassays. The results showed that the use of 100 μg of chloramine-T per ml, 500 to 1,000 μCi of Na ^{125}I per mg of protein, and a 10-min oxidation reaction time produced globulins of both high specific radioactivities and immunospecificities. Criteria were established for evaluating and determining optimal concentrations of iodine-labeled globulin for use in radioimmunoassays. The results of this investigation indicated that the amount of labeled indicator globulin used in radioimmunoassays should be based upon protein concentration rather than radioactivity. (auth)

14498 NOVEL METHOD FOR THE DETERMINATION OF GUANOSINE 3':5'-CYCLIC MONOPHOSPHATE (CYCLIC GMP). Shibuya, M.; Arai, K. I.; Kaziro, Y. (Tokyo Univ.). Biochem. Biophys. Res. Commun.; 62: No. 1, 129-135(6 Jan 1975).

A sensitive enzymatic procedure for the assay of cyclic GMP (cGMP) was developed, which utilizes the highly specific interaction of the E. coli polypeptide chain elongation factor Tu (EF-Tu) with GDP. The present method includes the conversion of cGMP to 5'-GMP by cyclic nucleotide phosphodiesterase and the transfer of ^{32}P from [γ-^{32}P]ATP to GMP to yield [β-^{32}P]GDP by ATP:GMP phosphotransferase (GMP kinase). The [^{32}P]GDP formed is incubated with an excess of EF-Tu · GDP in the presence of EF-Ts, and after the exchange reaction is completed, the radioactivity bound to EF-Tu is determined by the nitrocellulose membrane filter technique. This procedure permits the detection of as small as 0.05 pmole of cGMP in several rat tissues with highly reproducible results. (auth)

14499 PULMONARY MICROEMBOLISM DURING INTRAMEDULLARY ORTHOPAEDIC TRAUMA. Modig, J.; Busch, C.; Olerud, S.; Saldeen, T. (Uppsala Univ.). Acta Anaesth. Scand.; 18: 133-143(1974).

Patients undergoing prosthetic hip surgery by the Charnley method were given ^{51}Cr-labelled platelets and ^{125}I-labelled fibrinogen the day before the operation. External monitoring of both kinds of radioactivity over the right lung was performed during the surgical procedure. A transient accumulation of ^{51}Cr radioactivity over the lung was noted during broaching of the femoral bone marrow and after impaction of the femoral prosthetic stem. Transient trapping of ^{125}I radioactivity was also recorded during the latter period. Arterial oxygen tension (Pa_{O_2}) dropped significantly after impaction of the femoral prosthesis. The correlation coefficient was -0.97 between deposition of ^{125}I radioactivity in the lung and the Pa_{O_2} reduction occurring after insertion of the femoral prosthesis. These results might indicate a pulmonary microembolism occurring during this stage of the operation, with concomitant pulmonary dysfunction. (DG)

14500 DISTRIBUTION AND SPREAD OF ^{51}Cr-LABELED LEUKEMIA CELLS IN MICE. Boranic, M.; Radacic, M.; Gabrilovac, J. (Institut Rudjer Boskovic, Zagreb). Exp. Hematol.; 2: 51-57(1974).

Cells of two transplantable murine leukemias, a lymphoid and a myeloid one, were labeled with ^{51}Cr in vitro and injected into histocompatible recipients. The amount of radioactivity was monitored in animals sacrificed every other day, until all the remaining animals had died with leukemia. The following organs were examined: spleen, lymph nodes, thymus and femur; liver, lungs, kidney and brain; and the blood. Throughout the period of observation, most of the activity was recovered in the liver (25 to 50% of the injected amount), spleen (5 to 15%), and blood (5 to 10%). Other organs each contained 1 to 3% or less, except thymus and brain, which remained essentially free of the label. As compared with cells from normal spleens, cells from both leukemias had higher affinity for liver and lower affinity for spleen and lymph nodes. Cells of lymphoid leukemia tended to remain circulating in the blood, whereas those of myeloid leukemia were sequestered extravascularly. (DG)

14501 QUANTITATION OF ERYTHROPOIESIS BY A NEW METHOD. IV. Studies Using ^{59}Fe and DF^{32}P Simultaneously in Haematological Diseases. Lockner, D. (Karolinska Sjukhuset, Stockholm). Scand. J. Haematol.; 13: 146-151(1974).

The reliability of quantitation of erythropoiesis using ^{59}Fe was tested by simultaneous studies of mean erythrocyte life span with DF^{32}P. Thirteen patients with common haematological disorders were studied. The mean erythrocyte life span as determined with ^{59}Fe did not differ from that determined with DF^{32}P. Differences exceeding 10% were found in only 3 cases. The derangements observed in haematological disorders corresponded well with earlier observations on large materials and with other methods. Thus the method is a reliable substitute for more laborious techniques when erythropoiesis is to be quantified. (DG)

14502 RADIOIMMUNOASSAY OF THYROTROPHIN RELEASING HORMONE (TRH). Visser, T. J.; Docter, R.; Hennemann, G. (Univ. Hospital, Rotterdam). Acta Endocrinol.; 77: 417-421(1974).

Immunization of rabbits with a conjugate in which L-pGlu-L-His-L-Pro-NH_2 (TRH) at the amide side has been coupled to bovine serum albumin (BSA) yielded anti-TRH antibody, which was detected by reaction of diluted antiserum with ^{3}H-TRH. A double antibody radioimmunoassay was developed in which 100 pg unlabelled TRH could be detected. Several analogues tested showed that only pGlu-His-Pro-OMe possessed comparable reactivity, while all the other compounds exhibited very little activity in the assay. (DG)

14503 SCREENING FOR BONE METASTASES: ARE ONLY SCANS NECESSARY. Pistenma, D. A.; McDougall, I. R.; Kriss, J. P. (Stanford Univ., CA). J. Amer. Med. Ass.; 231: No. 1, 46-50(6 Jan 1975).

The results of total skeletal scintigraphy with technetium 99m-labeled diphosphonate in 200 patients with biopsy-proven primary cancer demonstrated abnormalities in 114; 57 had normal roentgenograms. In 32 of the 57 patients, the abnormalities were ascribed to malignant lesions. This is a false-negative rate of 17% for the roentgenographic examinations. Only three patients had abnormal roentgenograms but normal scans, a yield of 1.6% false-negative scans. In a comparison of scan and roentgenographic findings with the skeleton divided into 12 regions, 119 of 160 abnormalities seen on scans but not on roentgenograms were attributed to tumor. Only five of 17 regions that were abnormal on roentgenogram but not on scans were unexplained false-negative findings. Thus, on a regional basis, the yields of false-negative roentgenograms and scans were 9.1% and 0.4%, respectively. (auth)

MATERIALS

14504 TREATISE ON MATERIALS SCIENCE AND TECHNOLOGY. Volume 5. Herman, H. (ed.). New York; Academic Press, Inc. (1974). 301p. (ISBN-0-12-341805-4).

Four reviews are included: solution thermodynamics, radiation studies of materials using color centers, four basic types of metal fatigue, and the relationship between atomic order and the mechanical properties of alloys. An abstract was prepared of the second review. (DLC)

For an abstract of an individual chapter see: 14701.

14505 HIGH TEMPERATURE MATERIALS. Part II. Preparation and Physical-Chemical Properties of High-Temperature Materials. Elyutin, V. P.; Kostikov, V. I.; Lysov, B. S.; Maurakh, M. A.; Mitin, B. S.; Mozzhukhin, E. I. Moscow; Metalurgiya (1973). 464p. (In Russian).

A description is given of the technology of high-temperature materials and is concerned with high- and very-high-temperature metallurgy. Topics considered include the theory and practice of smelting, casting, powder metallurgy, the application of coverings, impregnating, and other technological procedures employed in the manufacture of high-temperature materials. Also given are physical-chemical, thermal, and mechanical properties of refractory metals and alloys, graphite compounds and high-temperature materials based on such compounds. Information is also included on the manufacture, analysis, and application of high-temperature materials, and on fabrication of zirconium, tantalum, boron nitrides, and thorium dioxide. (108 figures, 47 tables, 49 references) (JPRS)

Ceramics and Cermets

Refer also to abstracts 13672, 13676, 13700–13702, 13778, 13779, 13788, 14590, 14632, 14701, and 15624.

14506 (CEA-CONF-2693) PREPARATION OF HAFNIUM CARBIDE BY CHEMICAL DEPOSITION IN VAPOR PHASE. Hertz, D.; Spitz, J.; Besson, J. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Metallurgie). 21 Mar 1974. 24p. (In French). (CONF-740570–2). Dep. NTIS (US Sales Only) $4.25.

From 8th plansee seminar: heat-resisting and wear-resisting sintered materials; Reutte, Austria (27 May 1974).

Deposition of HfC on substrates of graphite, Mo, WC–Co cermets, and HfC frits by reaction of $HfCl_4$ and methane in the presence of H_2 was studied. Effects of the temperature (1200 to 1500°C), H_2/CH_4 ratio (0 to 100), and $CH_4/HfCl_4$ ratio (0 to 20) on the nature, composition, and morphology of the material deposited were determined. The speed of growth of the deposited phase is a function of the H_2/CH_4 ratio and reaches a limiting value at a ratio of ≥ 50. The nature and composition of the material deposited are functions of the temperature and of the [C/Hf] ratio of the gaseous phase. Conditions under which stoichiometric HfC can be obtained are determined and tabulated. Adherence of the HfC to the substrate is excellent when the carbide contains no free C. The porosity is very low and the hardness varies with the nature and composition of the deposited material. Analysis of the deposition curves showed the existence of two different deposition mechanisms for both C and Hf, which explains the unusual shape of the curve of product composition vs gaseous-phase composition. (9 fig, 4 tables) (JSR)

14507 (CEA-R-4573) THERMODYNAMIC STUDY OF PLUTONIUM CARBONITRIDES AT HIGH TEMPERATURES. de Franco, M. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Etudes des Combustibles a Base de Plutonium; Paris-11 Univ., 91–Orsay (France)). Apr 1974. 124p. (In French). INIS.

Thesis.

High temperature Pu–C–N ternary diagram is investigated using nitrogen pressure measurements obtained by reduction of PuN by carbon. Free energy of formation of Pu_2C_3, PuN, and PuC are derived from these experiments between 1600 and 2000°K. The ideality of the PuC–PuN solid solution is demonstrated for a N/Pu ratio greater than 0.75. Equilibrium pressure measurements have displayed the solubility of PuN in PuC_2, which is confirmed by neutron diffraction study of Ce (C_2,N). A statistical model, based on the pairwise interaction energies, is established for a fcc crystal structure to account for nitrogen equilibrium pressure above the Pu(C_2,N)–Pu(C_2,N) system. The energetic parameters computed are qualitatively analyzed. (FR)

14508 (CEA-R-4608) HIGH TEMPERATURE PLASTIC DEFORMATION OF URANIUM DIOXIDE AND CARBIDE. Guerin, Y. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Oct 1974. 95p. (In French). Dep. NTIS (US Sales Only) $7.75.

Thesis. Submitted to Lyon Univ., France.

A high-temperature compression apparatus was set up to investigate plastic deformation of sintered uranium dioxide and carbide as a function of temperature T (up to 1800°C) and strain rate $\dot{\epsilon}$ ($7 \cdot 10^{-4}$ to $7 \cdot 10^{-2}$/min). Stoichiometric uranium dioxide exhibits extensive plasticity above 1000°C. At high temperatures and low strain rates, the following equation fits the data: $\dot{\epsilon} = C^{te}\ \sigma^{4.5} \exp(-96000/RT)$, where σ is the steady-state flow stress (3 – 10 kg/mm²). Deformation occurs probably by a Weertman or Nix and Barrett mechanism. In the range 1000 to 1400°C, heterogeneous deformation is observed in the sample with a yield drop and a plateau in the compression curve. The value of $n = (\partial \ln \dot{\epsilon}/\partial \ln \sigma)_T$ where σ is then the upper or lower yield point (13 to 30 kg/mm²) equals about 17. The apparent activation volume remains equal at about 30 b^3 (b = Burgers vector) and the apparent activation enthalpy is about 100 kcal/mole. Below 1000°C, semi-brittle fracture occurs after a small plastic deformation; fractographs obtained by the plastic-carbon replica technique show intergranular and transgranular fracture. Slightly hyperstoichiometric uranium carbide becomes ductile between 1000 and 1200°C, depending on strain rate and grain size. Deformation arises homogeneously and the data can be fitted by the equation: $\dot{\epsilon} = C^{te}\ \sigma^{5.3} \exp(-110{,}000/RT)$, where σ is the flow stress at 0.4% plastic deformation. Deformation mechanism is probably climb-controlled dislocations glide. (45 fig, 4 tables, 169 references) (auth)

14509 (IAEA-158) FACILITIES AND TECHNOLOGY NEEDED FOR NUCLEAR FUEL MANUFACTURE. Proceedings of a Study Group Meeting, Grenoble, France, 4–15 September 1972. (International Atomic Energy Agency, Vienna (Austria)). 1973. 631p. (CONF-720966-).

Twenty-nine papers were presented by the study group on ores processing, preparation of UO_2, fuel pellets, gaseous diffusion, carbide fuels, Zr alloy cladding materials, fuel element fabrication, and fuel reprocessing. (JRD)

14510 (IFA-MN-21-1974) PHASE EQUILIBRIUM MODIFICATIONS IN MASSES OF THE UO_2–SiO_2 SYSTEM DURING HIGH-FLUX IRRADIATION. Lungu, S.; Radulescu, O. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 14p. (In French). (SM-190/37). Dep. NTIS (US Sales Only) $4.00.

Microscopic examinations were made on UO_2–SiO_2 samples irradiated to 20,000 MWd/t at 200 to 1500°C. Changes observed in the modification of the dimensions and the volume fraction of the UO_2 crystals and the structural modification of the spinodal mass, the precipitation of fission gas, and the stability of phases during irradiation were discussed. The grain growth and the low dependence of the dimensions of crystals and fission gas bubbles indicate a diffusion process induced by irradiation with a large diffusion length, possible in the single jump diffusion model. The decrease of the solubility of fission gases with temperature can explain the threshold for the appearance of fission gas bubbles. The possibility of a swelling which decreases with the increase of the hydrostatic pressure is noted. (8 fig) (tr-auth)

14511 (JUL-1045-FP) MODEL CALCULATION FOR THE α–α' PHASE TRANSITION IN METAL–HYDROGEN SYSTEMS. Horner, H.; Wagner, H. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Reaktorentwicklung). Feb 1974. 39p. INIS.

The α–α' ("gas-liquid") part of the phase diagram of hydrogen dissolved in metals is calculated and compared with experiments for H in Nb. The underlying lattice model includes a hard-core repulsion between protons and an elastic interaction mediated by the host metal lattice. The long-range part of this interaction is treated in mean field approximation. For the hard-core repulsion and the microscopic part of the elastic interaction, low-density cluster expansions, and Monte-Carlo calculations are investigated. Reasonable agreement with experimental data is obtained if the microscopic contribution of the elastic interaction is properly taken into account. (INIS)

14512 (ORNL-TM-2090) FUELS AND MATERIALS DEVELOPMENT PROGRAM QUARTERLY PROGRESS REPORT FOR PERIOD ENDING DECEMBER 31, 1967. Patriarca, P.

(comp.). (Oak Ridge National Lab., Tenn. (USA)). Apr 1968. Contract W-7405-eng-26. 207p. Dep. NTIS $13.50.

Research programs are summarized on fuel element development, radiation effects on reactor alloys, mixed nitride fuels, nondestructive testing, sintered aluminum products, sol-gel fast reactor fuels, weldability of Ni alloys, Zr metallurgy, and radiation effects on fuel materials. (JRD)

14513 (PUC-TN-7/74) EPR IDENTIFICATION OF A NEW HOLE TRAPPED CENTER IN IRRADIATED BERYLLIUM OXIDE. Maffeo, B.; Herve, A.; Hector, A. (Pontificia Universidade Catolica do Rio de Janeiro (Brazil). Instituto de Fisica). May 1974. 27p. (In French). INIS.

Single crystals of beryllium oxide irradiated with fast neutrons were studied by EPR after annealing at 500°C. One of the spectra is attributed to a defect constituted by a trapped hole on one oxygen ion having two cation vacancies as nearest neighbors, one of which situated on the $\vec{c}$ axis. A theoretical calculation of the $\vec{g}$ tensor was done and results compared with experiment. (INIS)

14514 (WANL-TME-1336) CARBON DIFFUSION IN THE GROUP IVB AND VB TRANSITION ELEMENT MONOCARBIDES. Tobin, J. M.; Adelsberg, L. M.; Cadoff, L. H.; Brizes, W. F. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Dec 1965. 32p. Dep. NTIS $4.75.

Published data on the diffusion of carbon in transition element monocarbides were critically reviewed. New data were summarized for the diffusion of carbon in Ti, Zr, Hf, V, Nb, and Ta monocarbides which were measured between 1700 and 3000°C by the layer-growth method. The observed parabolic layer-growth kinetic behavior results from the chemical diffusion of carbon in the carbide phases. An atomic jump mechanism and a general theory of diffusion in the B1 crystal structure monocarbides were also proposed. (27 references, 5 fig, 5 tables) (auth)

14515 (WANL-TME-1760) METAL DIFFUSION IN THE REFRACTORY MONOCARBIDES. Cadoff, L. H.; Adelsberg, L. M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1 Apr 1968. 37p. Dep. NTIS $5.00.

It is proposed that in the Group IVB and VB transition metal monocarbides, migration of three types of defects—single metal vacancies, metal-carbon vacancy pairs and carbon-metal-carbon trivacancies—may contribute to metal self-diffusion. Common to each of these mechanisms are metal vacancy jumps of $\sqrt{2}/2\ a_0$ in the ⟨110⟩ type directions. From calculations based upon a volume fluctuation model for diffusion, it was suggested that the trivacancy and the single metal vacancy were respectively the most and least mobile of the defects. The metal diffusivities via each diffusion mechanism were calculated for the case of random distribution of both carbon and metal vacancies on their own sublattice. It is concluded that, in general, the metal self-diffusion coefficients should decrease with increasing stoichiometry in these materials. (10 figures, 4 tables, 19 references) (auth)

14516 BONDING IN URANIUM OXIDES: THE ROLE OF 5F ELECTRONS. Veal, B. W.; Lam, D. J. (Argonne National Lab., Ill. (USA)). Phys. Lett., A; 49: No. 6, 466-468(21 Oct 1974).

X-ray photoemission spectra of valence and bonding bands of UO_2, U_3O_8 and UO_3 are presented. The gradual transfer of localized 5f electrons into the bonding band as a function of oxygen content has been studied in these oxides. (auth)

14517 ON ELECTRONIC STRUCTURE OF VANADIUM AND TITANIUM MONOXIDES. Zhurakovskij, E. A.; Bondarenko, T. N.; Dzeganovskij, V. P. (AN Ukrainskoj SSR, Kiev. Inst. Problem Materialovedeniya). Dokl. Akad. Nauk SSSR; 215: No. 6, 1360-1363(Apr 1974). (In Russian).

The purpose of the study was the construction of the energy schemes of TiO and VO with the use of results of x ray and electron analyses, and also a comparison of experimental data on the electron structure of TiO and VO with available calculations carried out at different times by various methods. It was established that the electron structures of TiO and VO are close to each other. From a consideration of the occupied part of the valence zone and of the conductivity zone it follows that its width in VO is about 31 eV and in TiO it is about 29 eV. The 4p-like states of the Me are distributed over the entire width and have a maximum approximately at the middle. The band of 3d-like states of the Me is also almost stretched out, and the maximum of the d-states, as also the maximum of the narrower O2p-like band, is close to the ceiling of the occupied part of the valence zone and the conductivity zone; at the bottom of this zone is the O2s-like band. The mutual spacing of the K- and L-absorption spectra of Me in TiO and VO show that bands of free p- and d-like states of Me in TiO and VO are strongly overlapping. (tr-SJR)

14518 THE HYDERABAD NUCLEAR FUEL COMPLEX: AN INTEGRATED VENTURE FOR NUCLEAR FUEL PRODUCTION. Kondal Rao, N. (Nuclear Fuel Complex, Hyderabad (India)). Nucl. India; 12: No. 2, 1-5,8(Oct 1973).

The Nuclear Fuel Complex at Hyderabad, India, constitutes the first essential step for attaining nuclear fuel production capability on a commercially viable scale. Extensive R & D efforts have now culminated in the establishment of this complex where many of the production plants have already been commissioned and regular production of fuel assemblies and zircaloy core components has just begun. The complex has seven major production units for sequential conversion of raw materials concentrates to finished fuel assemblies and reactor components. These are: (1) the zirconium oxide plant, (2) the zirconium sponge plant, (3) the zircaloy fabrication plant, (4) the uranium oxide plant, (5) the enriched uranium oxide plant, (6) the ceramic fuel fabrication plant, and (6) enriched fuel fabrication plant. The entire plant has been designed and installed indigenously with only some specialized equipment not manufactured in the country being imported. Short descriptions of the plants are given. (INIS)

14519 HIGH TEMPERATURE X-RAY DIFFRACTION USED TO INVESTIGATE THE REDUCTION OF UO_2 BY CARBON. Pialoux, A. (Paris Univ., Orsay, France). Rev. Int. Hautes Temp. Refract.; 11: No. 2, 147-154(Apr 1974). (In French).

Measurements of parameters were made on the UC_2 and UC phases which appear when UO_2 is progressively reduced by C between 1,400 and 1,900°C under controlled pressures of CO. It is shown that at the first monovariant equilibrium (graphite UO_2, α, UC_2, CO) the tetragonal phase α-UC_2 is substoichiometric. Moreover, it seems that the amount of oxygen contained in α-UC_2 decreases as temperature increases. The fcc-phase UC which exists as the second monovariant equilibrium (UC_2, α or β-UC_2, UC, CO) is superstoichiometric; its oxygen content seems to increase with the increasing temperature. An oxygen-rich and high temperature metastable mono-carboxide $UC_{1-x}O_x$ was observed. (FR)

14520 EFFECT OF THE INTERFACE ON LONGITUDINAL TENSILE PROPERTIES. Metcalfe, A. G.; Klein, M. J. pp 125-168 of Interfaces in Metal Matrix Composites. New York; Academic Press, Inc. (1974).

Theories of strong and weak interfaces are reviewed with special attention to interaction zone theories and to theories of reinforcement weakening by surface damage. The effect of interface reaction on the strength of class-III composite systems, where the reaction between reinforcement and matrix leads to the formation of a chemical compound layer, is examined in the cases of titanium–boron, titanium–silicon carbide, and titanium–alumina composites. Interface effects on the strength of pseudoclass-I composite systems, where stable oxide films break down to permit reaction only after extended holding times at elevated temperatures, are considered in the case of aluminum–boron and aluminum–stainless steel composites, with allowance for effects of processing. Interface effects on the strength of class-II systems, where matrix and filament are essentially insoluble but wet each other, are also briefly discussed. Inferences for the relation of the interface condition to the longitudinal strength conclude the review. (IAA)

14521 COMPOUNDS IN THE SYSTEM $BaO–Sc_2O_3$. Kwestroo, W.; van Hal, H. A. M.; Langereis, C. (Philips Research Labs., Eindhoven, Netherlands). Mater. Res. Bull.; 9: No. 12, 1623-1629 (Dec 1974).

Apart from the already known compounds $Ba_3Sc_4O_9$ and $BaSc_2O_4$, tetragonal $Ba_2Sc_2O_5$ was found. This phase is the only compound formed at low temperature (1000°C). At higher temperatures $Ba_2Sc_2O_5$ is transformed into the other stable compounds, whereas remaining $Ba_2Sc_2O_5$ may dissolve excess BaO, changing the unit cell constants. Tetragonal compound $Ba_5Sc_6O_{15}$ was also observed. (7 tables) (auth)

14522 COMPOUNDS IN THE SYSTEM $BaO–Y_2O_3$. Kwestroo, W.; van Hal, H. A. M.; Langereis, C. (Philips Research Labs., Eindhoven, Netherlands). Mater. Res. Bull.; 9: No. 12, 1631-1637(Dec 1974).

Starting with BaO and Y_2O_3, four compounds are found in the $BaO–Y_2O_3$ system. At high temperatures (above 1200°C), two compounds mentioned in literature are found: $Ba_3Y_4O_9$ and BaY_2O_4. Heating the oxidic mixtures at 900°C results in the formation of a new compound $Ba_2Y_2O_5$. This compound is transformed at 1000°C into another new compound: $Ba_4Y_2O_7$. X-ray data of the four compounds are given in detail. (7 tables) (auth)

14523 TURNING HIGH-TEMPERATURE ALLOYS WITH BORAZON TOOLS. Gorsler, F. W. Technical Paper No.

MR73-145. Dearborn, MI; Society of Manufacturing Engineers (1973). 16p.

Advantages of Borazon CBN (cubic boron nitride) cutting tools for the machining of high temperature alloys such as Inconel 718 and René 95 are discussed. It provides an increase in metal removal rate while improving surface finish and chip formation and disposal. In roughing, feeds are ~80% those of carbide tools and the depth is the same. Metal removal in lb/min is increased by 5.1 or more. The tool's thermal stability permits hot machining in a range where the work material has lost some of its strength (1800 to 2000°F). Carbide tools at these temperatures would fail in seconds. Reduced surface reactivity with the workpiece insures fewer tears and pulled out grains. Because of the tool's brittle nature, its tolerance for interrupted or scale cuts is low. Typical engine parts being turned with Borazon include disks, cones, and cylinders. (Metals Abstr.)

14524 NICKEL–URANIUM CATALYST. Nicklin, T.; Farrington, F. US Patent 3,847,836. 12 Nov 1974. Filed date 11 Jul 1972. 12p.

Steam reforming catalysts are described containing as active components nickel, and/or nickel oxide, together with uranium oxide, supported on a carrier. The ratio of the proportions of uranium to nickel by weight is from 0.45 to 0.76 and the uranium content lies within the range of 5 to 30 wt % of the catalyst composition. Small quantities of alkali metal oxide may also be present in the composition. The preferred carriers include α-alumina. (auth)

14525 PRODUCTION OF NUCLEAR FUEL. Lefevre, R. L. R. (to United Kingdom Atomic Energy Authority). US Patent 3,846,154. 5 Nov 1974. Priority Date 23 Dec 1970, United Kingdom of Great Britain and Northern Ireland. 4p.

Most nuclear fuel spheroids have a fairly thick coating of porous pyrocarbon followed by denser coatings. With nuclear fuel in an oxide form, it becomes necessary to apply the innermost layer in an atmosphere rich in carbon monoxide so as to inhibit the reaction $C + O \rightarrow CO$. The supply of carbon monoxide is continued until the porous layer has been sealed by other high density layers. The invention reduces or eliminates the need for a carbon monoxide supply by the application of a flash sealing layer direct on the spheroid before application of the porous layer. (auth)

14526 HIGH TEMPERATURE STUDIES OF THE SYSTEMS FORMED WITH NEODYMIUM SESQUIOXIDES WITH YTTRIUM AND YTTERBIUM SESQUIOXIDES. Coutures, J.; Verges, R.; Foex, M. (CRNS, Odeillo, France). Mater. Res. Bull.; 9: No. 12, 1603-1611(Dec 1974). (In French).

The systems formed by Nd_2O_3 with respectively Y_2O_3 and Yb_2O_3 showed several very extended solid solutions at high temperature, near the melting point. The phases determined "in situ" at high temperature are often different from those obtained in annealed or quenched samples. (8 fig) (auth)

14527 EXPERIMENTAL STUDY OF THE ELECTRICAL CONDUCTIVITY AND IONIC TRANSPORT NUMBER OF HfO_2 AND ZrO_2 AT 1200 TO 1600°C. Guillot, A.; Canale, P.; Anthony, A. M. (CNRS, Orleans-la-Source, France). Rev. Int. Hautes Temp. Refract.; 11: No. 2, 93-101(Apr 1974). (In French).

The electrical conductivity of hafnium and zirconium oxides was measured at 1200 to 1600°C and 1 to 10^{-10} atm oxygen. The emf method was used to measure the ionic transport number over the same ranges of temperature and partial pressures of oxygen. The electrical conductivity of HfO_2 decreases with P_{O_2} and the ionic transport number increases as P_{O_2} decreases and approaches unity in the lower P_{O_2} range. For ZrO_2, low variations of conductivity and ionic transport number with P_{O_2} were observed. The ionic transport number is high and decreases slowly in the lower P_{O_2} range. (FR)

14528 ANTIFERROMAGNETISM OF URANIUM AND THORIUM BORIDES. Chechernikov, V. I.; Ali-zade, N. Kh.; Ramazanzade, M. G.; Slovyanskikh, V. K.; Lisitsyn, L. M.; Guseinov, N. G. (Moscow State Univ.). Sov. Phys.-Solid State (Engl. Transl.); 16: No. 4, 681-682(Oct 1974).

Translated from Fiz. Tverd. Tela; 16: No. 4, 1056-1059(Apr 1974).

Magnetic properties of UB_4–ThB_4 solid solutions and UB_2, UB_{12} compounds were investigated. The solutions are antiferromagnetic up to 80 at. % ThB_4. The Neél temperature decreases with increasing ThB_4 content from 118°K for pure UB_4 to 91°K for a sample with 70 at. % of ThB_4. The Curie–Weiss law is observed in the paramagnetic region with the parametric Curie temperature $\Theta_p < 0$ and decreasing towards zero with dilution. At maximum dilution the effective magnetic moment μ_{eff} is 2.85 μ_B. X-ray structural analysis indicates that all compounds are solid solutions having a tetragonal structure of the UB_4 type. The lattice parameters increase with ThB_4 content. (4 fig) (auth)

14529 STUDIES IN COMPLEX METAL OXIDE SYSTEMS: FERGUSONITE. Darshne, V. S.; Deshpande, V. V. (Inst. of Science, Nagpur, India). pp 315-334 of Proceedings of the Chemistry Symposium. Vol. II. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P2.

Fergusonite ($YBbO_4$) was synthesized by solid state reaction and indexed on the basis of orthorhombic symmetry. The $YNbO_4$–$UTiO_4$ and $YTaO_4$–$CeTaO_4$ systems were studied. (LK)

14530 PHASE TRANSITION STUDIES OF α, β, AND δ-U_3O_8. Momin, A. C.; Deshpande, V. V.; Karkhanavala, M. D. (Bhabha Atomic Research Centre, Bombay). pp 341-346 of Proceedings of the Chemistry Symposium. Vol. II. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P2.

X-ray diffraction studies of α, β, and δ phases of U_3O_8 were undertaken, and accurate cell parameters were determined. The phase transitions were studied by high-temperature x-ray diffractometric and differential scanning calorimetric techniques. (auth)

14531 STUDY OF THE ELECTRIC QUADRUPOLE INTERACTION (EQI) IN $(Pb_{0.90}-Ba_{0.10})ZrO_3$ BY PERTURBED ANGULAR CORRELATIONS. Saitovitch, H. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). Notas Fis., Cent. Brasil. Pesqui. Fis.; 22: No. 4, 99-106(1974).

The EQI was investigated at 22 to 210°C by time differential perturbed angular correlation measurement. $(Pb_{0.90}Ba_{0.10})ZrO_3$ was doped with ^{181}Hf. According to crystal structure studies this compound exhibits phase transitions at 140°C (antiferroelectric → ferroelectric) and at 190°C (ferroelectric → paraelectric). It is shown that the electric field gradient (EFG) exhibits a decrease in the measured range of temperature. In the cubic phase a remaining EFG is observed, which is probably caused by lattice imperfections in the source. (auth)

14532 REMARKS ON THE EFFECTS OF PRESSURE ON EuO AND EuS. Lara, S.; Xavier, R. M. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). Notas Fis., Cent. Brasil. Pesqui. Fis.; 22: No. 3, 91-95(1974).

From the variation of the Curie temperatures of EuO and EuS with pressure and using an indirect exchange mechanism, the variation of the energy gap E_z with lattice parameter is obtained: 2.4 eV/Å for EuO and 1.6 eV/Å for EuS. (auth)

14533 Tl_2O–V_2O_5 SYSTEM. Touboul, M.; Ganne, M.; Cuche, C.; Tournoux, M. (Univ. Nantes, Paris). Z. Anorg. Allg. Chem.; 410: No. 1, 1-8(Nov 1974). (In French).

The Tl_2O–V_2O_5 system has been studied by thermal analysis and x-ray analysis. The entire phase diagram is reported. The symmetry and cell dimensions of most of the phases are derived from single crystal photographs. The compounds rich in vanadium are isomorphous with potassium analogues. Such an isomorphism does not exist for compounds like $Tl_4V_2O_7$ and Tl_3VO_4; in these cases, the lone pair of thallium(I), doubtless, is stereochemically active. (auth)

14534 ELECTRON-OPTICAL STUDY OF THE PRODUCTS OF BORON NITRIDE SHOCK COMPRESSION. Kurdyumov, A. V.; Ostrovskaya, N. F.; Pilyankevich, A. N.; Frantsevich, I. N. (Inst. of Problems of Material Management, Kiev). Dokl. Akad. Nauk SSSR; 215: No. 4, 836-838(1 Apr 1974). (In Russian).

The effect of shock compression on the actual graphite-like structure of BN was studied both up to the beginning of the phase transition and in the two-phase region. Under shock compression the graphite-like structure becomes wirtzite-like. Electronograms of the deformed BN showed non-oriented grains, grains with [0001] orientation axis, and very coarse grains. The reflection intensities for the two grain structures are tabulated. A mechanism is proposed for the phase transition. (JSR)

14535 DESORPTION OF NIOBIUM OXIDES FROM NIOBIUM–OXYGEN SOLID SOLUTION UNDER 3×10^{-7} TO 3×10^{-5} TORR OF OXYGEN BETWEEN 1700 AND 2350°K. Jupille, J.; Michel, J. M. (CNRS, Nancy). J. Less-Common Metals; 39: No. 1, 17-34(Jan 1975). (In French).

Products of this desorption process are NbO and NbO_2, which were demonstrated to be formed by a superficial reaction after chemisorption of molecular oxygen on to two distinct sites. Two models for the process are discussed. In the first, the speeds of desorption are assumed to be a function of the surface coverage.

This model suggests that the binding energy of the adsorbed oxygen atoms should vary with the coverage. In the second model, the bulk concentration is assumed to be variable. It is shown that at low concentration this model is related theoretically to the first. Good agreement with experiment was found for this model in the steady state throughout the whole homogeneity range of the solid solutions. In the transient state, however, the model only applied to thin samples. (8 fig, 5 tables, 27 references) (auth)

14536 STRUCTURE REFINING AND ELECTRON TRANSITIONS OF $EuScO_3$. Faucher, M.; Caro, P. (CNRS, Bellevue, France). Mater. Res. Bull.; 10: No. 1, 1-8(Jan 1975). (In French).

The perowskite compound $EuScO_3$ was synthesized by solid-state reaction between the two oxides in a zirconia furnace. The unit cell parameters, as well as the structure were refined. Distortion is important, very short Eu-O distances are found, rare earth coordination is reduced to 8. Absorption and fluorescence spectra were recorded at 0 to 30,000 cm^{-1}. Crystal-field splittings are in agreement with a single, well-defined C_s site for Eu^{3+}. (5 tables, 3 figures) (auth)

14537 HIGH-TEMPERATURE THERMODYNAMICS OF THE SOLID SOLUTIONS OF HYDROGEN IN BCC VANADIUM, NIOBIUM, AND TANTALUM. Kleppa, O. J.; Dantzer, P.; Melnichak, M. E. (Univ. of Chicago). J. Chem. Phys.; 61: No. 10, 4048-4058(15 Nov 1974).

The high-temperature thermodynamic properties of V + H_2 and Nb + H_2 solid solutions were studied by a combined calorimetric and equilibrium method at 264, 300, and 437° (V), and at 356 and 440° (Nb). Results show that the relative partial enthalpies and entropies of hydrogen in these solid solutions are very nearly independent of temperature. The observed enthalpies are compared with data derived from equilibrium work, and with earlier data at 430° for Ta + H_2. From the equilibrium pressures and partial enthalpies, the partial entropies and partial excess entropies of hydrogen were calculated. The limiting values (at $N_H = 0$) of the excess entropies are compared with values derived from the sum of the contributions from the volume expansion and from vibrational and electronic heat capacity terms. These calculated values are systematically about 0.5-1.0 cal/deg · g-atom lower than the experimental ones. This difference is too small to allow for any site degeneracy term in the excess entropies. (5 tables, 5 figures, 28 references) (auth)

14538 SODIUM COMPATIBILITY STUDIES OF LOW FRICTION CARBIDE COATINGS FOR REACTOR APPLICATION. Whitlow, G. A.; Miller, R. L.; Schrock, S. L.; Wu, P. C. S. (Westinghouse Electric Corp., Madison, PA). Corrosion; 30: No. 12, 420-426(Dec 1974).

From Corrosion/74; Chicago, IL (4 Mar 1974).

Based on isothermal sodium corrosion and thermal cycling studies, the D-gun applied chromium carbide coatings, with nichrome and Inconel 718 binders, are the best candidates for coating the stainless steel fuel assembly duct load pads in the FFTF. Average sodium corrosion rates of these coatings at 1160°F were ≤ 0.25 mpy (6.35 μm/h). Results of sodium exposure at 1160°F or thermal cycling in sodium between 1160 and 800°F have ruled out plasma sprayed chromium carbide and titanium carbide coatings with molybdenum or nichrome binders for use in this application. (7 figures) (auth)

14539 SINTERING OF ThO_2 AND ThO_2-UO_2 SOLID SOLUTION PELLETS. Haydt, H. M.; Capocchi, J. D. T.; Moraes, E.; Gentile, E. F. (Instituto de Energia Atomica, Sao Paulo (Brazil). Divisao de Metalurgia Nuclear). Metalurgia (Sao Paulo); 26: No. 157, 959-963(Dec 1970). (In Portuguese).

From 25th annual meeting of the Brazilian association of metals; Porto Alegre, Brazil (Jun 1970).

The sintering of ThO_2 and ThO_2-UO_2 solid solution pellets, prepared with thorium oxide by calcination of thorium oxalate, was carried out with the purpose of comparing the results with the ones of former papers. In the previous studies, thorium dioxide prepared from thorium sulfate was utilized. Sintering was done in air and in an argon atmosphere. The effects influencing the ThO_2 sinterability are analyzed and the characteristics of the powders used are determined. Based on the study of the sintering results of both series, it is concluded that the formation of solid solution is due to the vaporization of the oxide UO_3. (INIS)

14540 REGULARITIES IN EROSION OF CARBIDES AND BORIDES IN ELECTRIC SPARK ALLOYING. Samsonov, G. V.; Verkhoturov, A. D.; Sychev, V. S.; Mikhajlov, V. V. Elektron. Obrab. Mater.; No. 2, 24-27(1974). (In Russian).

For English translation see the journal Appl. Electr. Phenom.

The results of the study of the regularities of the electric erosion of carbides and borides during electric spark alloying of the transition metals of the IV-VI and VII groups were reported and discussed. It was shown that the degree of localization of the valence electrons of the metals, forming the compounds, can serve as a criterion for the evaluation of the erosion properties of refractory compounds. (tr-auth)

14541 ELECTRON MICROSCOPY OF UO_2 POWDERS. de Antunes Bueno, R. P.; Pimentel, C. A.; Nishioka, I. (Instituto de Energia Atomica, Sao Paulo (Brazil). Divisao de Metalurgia Nuclear). Metalurgia (Sao Paulo); 27: No. 162, 331-340(May 1971). (In Portuguese).

From 25th annual meeting of the Brazilian association of metals; Porto Alegre, Brazil (Jun 1970).

Studies on the properties of UO_2 powders for fuel element fabrication have been extended through electron microscopy. The adopted technique for replica preparation, the observed microstructures and the results of the comparison of those micrographies with others, obtained with powders of different precipitation conditions are described. The results obtained with ThO_2 powders are also presented. (INIS)

14542 X-RAY DIFFRACTOMETRIC STUDY OF INVERSE ELECTROCHEMICAL TRANSFORMATION MECHANISMS OF DIELECTRIC REVERSIBLE SEMICONDUCTOR IN Nb_2O_5. Palatnik, L. S.; Malyuk, Yu. I.; Belozerov, V. V. (Khar'kovskij Politeknicheskij Inst. (Ukrainian SSR)). Dokl. Akad. Nauk SSSR; 215: No. 5, 1182-1185(11 Apr 1974). (In Russian).

During the study of the physical and chemical properties of Nb_2O_5 it was observed that during contact of baked Nb_2O_5 tablets with graphite rods, on which hydrogen was first electrolytically adsorbed, at the point of contact a blue spot appeared. The change of the color of the tablets by contact indicated the emergence of structure defects. In order to establish the type of structure defects of the Nb_2O_5, the temperature dependence of the electric conductivity of the reaction products was studied and x-ray structural studies were made. The results obtained indicate the possibility of an electrochemical process for the introduction of proton defects in the dense dielectric oxide and identification of this conversion by diffractometric studies. The results also show the reversibility of the electrometric conversions occurring in Nb_2O_5. (INIS)

14543 POSITRON ANNIHILATION IN CERTAIN ZIRCONIUM COMPOUNDS WITH NONMETALLIC ATOMS. Tsyganov, A. D.; Andrievskii, R. A.; Gorbachev, V. V.; Savin, V. I. Inorg. Mater. (USSR) (Engl. Transl.); 10: No. 6, 885-887(Jun 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 6, 1030-1032(Jun 1974).

It has been found that the annihilation spectra of zirconium-based metalline phases are similar and that these spectra differ from the spectrum of ZrO_2. (auth)

14544 SOLID SOLUTIONS IN THE SYSTEM Y_2O_3–HfO_2–SiO_2. Parfenenkov, V. N.; Grebenshchikov, R. G.; Domanskii, A. I. (Inst. of Silicate Chemistry, Moscow). Inorg. Mater. (USSR) (Engl. Transl.); 10: No. 6, 919-921(Jun 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 6, 1071-1074(Jun 1974).

Complex cubic solid solutions in the system Y_2O_3–HfO_2–SiO_2 were studied. Curves of changes in unit-cell parameters, refractive indices, and pycnometric density of specimens of HfO_2-based cubic solid solutions in the system Y_2O_3–HfO_2 have breaks at 33.33 mole % Y_2O_3, indicating formation of a pyrochlore structure. Corresponding curves for polycomponent fluorite-like cubic solid solutions in the section with a constant HfO_2 content of 66.66 mole % have breaks at 16.66 and 22.22 mole % SiO_2, and in the binary section HfO_2–$Y_2Si_2O_7$ at 66.66 mole % HfO_2, apparently owing to ordering of the structure. (auth)

14545 ELECTRICAL AND MAGNETIC PROPERTIES OF PEROVSKITES $YTiO_3$, YVO_3, AND $LaVO_3$. Bazuev, G. V.; Perelyaev, V. A.; Shveikin, G. P. (Inst. of Chemistry, Sverdlovsk, USSR). Inorg. Mater. (USSR) (Engl. Transl.); 10: No. 6, 915-918(Jun 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 6, 1066-1070(Jun 1974).

Resistivity and thermo-emf measurements show that at 77 to 1273°K $YTiO_3$, YVO_3, and $LaVO_3$ are p-type semiconductors. Magnetic susceptibility measurements at 77 to 650°K establish that YVO_3 and $LaVO_3$ are antiferromagnetic with Néel points of 110 and 144°K, respectively. $YTiO_3$ is paramagnetic, its molar susceptibility obeys the Curie–Weiss law, and the Weiss constant is positive. The electrical and magnetic properties of the compounds are closely correlated with their structural characteristics. (auth)

14546 MECHANISM OF THE RADIATION-INDUCED PHASE TRANSITION IN FERROELECTRICS OF THE $BaTiO_3$ TYPE.

Dem'yanov, V. V.; Shchedrin, M. I. (Scientific-Research Physico-chemical Inst., Moscow). Inorg. Mater. (USSR) (Engl. Transl.); 10: No. 6, 909-914(Jun 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 6, 1057-1065(Jun 1974).

A study was made of the temperature dependence of the super-high-frequency dielectric constant of barium titanate after irradiation in a reactor. There is an increase in the frequency dependence of the shift of the position of the peak of the dielectric constant as the dose Φ of fast neutrons increases. Detailed $\Phi-T$ diagrams of the irradiated $BaTiO_3$ were obtained for various measurement kinetics. A theoretical description is given and two mechanisms suggested for the temperature shift of the phase transition in the irradiated ferroelectrics. (4 fig) (auth)

14547 TWO STEP PROCESS FOR PRODUCING BERYLLIUM HYDRIDE FROM A BERYLLIUM HALIDE. Laran, R. J.; Kobetz, P.; Johnson, R. W. Jr. (to Ethyl Corp.). US Patent 3,830,906. 20 Aug 1974. Filed Date 23 Apr 1965. 4p.

A novel process is described for the preparation of beryllium hydride. More specifically, it relates to a process wherein a beryllium alkyl is prepared by a novel method and, without separation from the reaction system, is pyrolyzed to produce beryllium hydride. (Official Gazette)

14548 FRACTURE MECHANICS OF CERAMICS. Volume 1. Concepts, Flaws, and Fractography. Conference held at University Park, Pennsylvania, July 11-13, 1973. Bradt, R. C.; Hasselman, D. P. H.; Lange, F. F. (eds.). New York; Plenum Publishing Corporation (1974). 471p. (CONF-730707-P1; ISBN-0-306-37591-5(Vol.1)). $28.00.

The symposium focussed on the mechanical behavior of brittle cracks in terms of the characteristics of cracks. In this volume, 23 papers are arranged under the headings Fracture Mechanics applied to Ceramics, Flaw Detection and Theoretical Aspects, and Fractography. Separate abstracts were prepared for two of the papers. (DLC)

For abstracts of individual chapters see: 13990 and 14549.

14549 FRACTURE MECHANICS, STATISTICAL ANALYSIS, AND FRACTOGRAPHY OF CARBIDES AND METAL CARBIDES COMPOSITES. Chermant, J. L.; Deschanvres, A.; Iost, A. (Univ., Caen, France). pp 347-366 of Fracture Mechanics of Ceramics. Vol. 1. Bradt, R. C. (ed.). New York; Plenum Publishing Corp. (1974).

From conference of fracture mechanics of ceramics; University Park, Pennsylvania, USA (11 Jul 1973). See CONF-730707-P1; ISBN-0-306-37591-5(Vol.1).

Fractography by scanning and transmission electron microscopy was used to study the fracture in transition metal carbides (TiC and WC) and composites (TiC-Co, TiC-Ni, TiC-NiCr and WC-Co). The fracture of the carbide crystals is always brittle with river patterns and Wallner lines. When the carbide crystals of the composites are small, the fracture is intergranular and dimples are observed in the matrix. The principal factor of the micrographic feature is the diameter of the carbide crystals. The morphology of the fracture path was investigated statistically using punctual analysis and a modification of the Johnson-Saltykov method. Results obtained on polished and fractured surfaces were compared by quantitative metallography. This investigation confirms that the WC-Co fracture by three-point bending is essentially intergranular and that this intergranular fracture path is random. Three-point bending tests were used in the investigation of the effective surface energy of crack initiation, γ_i, and of the stress intensity factor, K_I, for WC-Co composites. It was first determined that the usual methods for such brittle materials are in agreement for WC-Co and permit the determination of the value of the critical stress intensity factor. Further, the variations of γ_i and K_{IC} were studied as a function of the mean particle size diameter of carbide crystals and of the different cobalt volumic ratio. The variations evolve regularly and can be explained by a statistical analysis of the fractured paths in SEM and TEM. (44 references, 20 fig) (auth)

14550 FRACTURE MECHANICS OF CERAMICS. Volume 2. Microstructure, Materials, and Applications. Conference Held at University Park, Pennsylvania, July 11-13, 1973. Bradt, R. C.; Hasselman, D. P. H.; Lange, F. F. (eds.). New York; Plenum Publishing Corporation (1974). 503p. (CONF-730707-P2; ISBN-0-306-37592-3(Vol.2)). $28.00.

Thirty papers are presented in this Volume, arranged under the headings microstructural effects; subcritical coach growth; and engineering, scientific, and design applications. Separate abstracts were prepared for four of the papers. (DLC)

For abstracts of individual chapters see: 14551-14554.

14551 FRACTURE OF DIRECTIONALLY SOLIDIFIED $CaO \cdot ZrO_2-ZrO_2$ EUTECTIC. Hulse, C. O.; Batt, J. A. (United Aircraft Research Labs., East Hartford, CT). pp 483-494 of Fracture Mechanics of Ceramics. Vol. 2. Bradt, R. C. (Ed.). New York; Plenum Publishing Corp. (1974).

From conference of fracture mechanics of ceramics; University Park, Pennsylvania, USA (11 Jul 1973). See CONF-730707-P2; ISBN-0-306-37592-3(Vol.2).

The fracture behavior of the $CaO \cdot ZrO_2-ZrO_2$ eutectic (mp 2300°C) directionally solidified at 10 cm/h was studied using the work-of-fracture technique and detailed examinations of the fracture surfaces. Below 1000°C, the lamellar structure appeared to have only a minor effect on the path of fracture when the direction of crack propagation was exactly perpendicular to the lamellae. There were usually appreciable effects for all other orientations. Above 1000°C, the eutectic behaved in the classic composite manner wherein a relatively strong minor phase (ZrO_2) reinforces a weaker ductile matrix phase. The energy required to propagate a slow moving crack through this microstructure increased by a factor of 28 from room temperatures to 1500°C (4.4 to 114×10^4 ergs/cm^2). (10 figs.) (auth)

14552 MICROSTRUCTURAL DEVELOPMENT AND FRACTURE TOUGHNESS OF A CALCIA PARTIALLY STABILIZED ZIRCONIA. Green, D. J.; Nicholson, P. S.; Embury, J. D. (McMaster Univ., Hamilton, Ont.). pp 483-494 of Fracture Mechanics of Ceramics. Vol. 2. Bradt, R. C. (Ed.). New York; Plenum Publishing Corp. (1974).

From conference of fracture mechanics of ceramics; University Park, Pennsylvania, USA (11 Jul 1973). See CONF-730707-P2; ISBN-0-306-37592-3(Vol.2).

The effect of microcrack formation on the brittle fracture of ceramics is discussed and a model presented to explain the effect of such a process zone on crack stability. The transient phenomena of stable crack growth is explained in terms of a microcrack zone of increasing size. Evidence supporting this model is presented for the case of a calcia partially stabilized zirconia which can form microcracks at the grain boundaries. (9 figs.) (auth)

14553 CRACK PROPAGATION IN A THERMALLY STRESSED CERAMIC REACTOR FUEL. Trantina, G. G.; Roberts, J. T. A. (Argonne National Lab., IL). pp 779-790 of Fracture Mechanics of Ceramics. Vol. 2. Bradt, R. C. (Ed.). New York; Plenum Publishing Corp. (1974).

From conference of fracture mechanics of ceramics; University Park, Pennsylvania, USA (11 Jul 1973). See CONF-730707-P2; ISBN-0-306-37592-3(Vol.2).

A finite-element stress analysis of a thermally stressed cylinder, with material parameters adjusted for temperature and porosity, was performed. A direct-energy approach was used to obtain strain energy-release rates from the finite-element results, and a displacement method was used to obtain stress-intensity factors. These values were then compared with experimentally measured critical values to predict crack initiation. Based on the analysis of the propagation of a single radial crack and of a number of regularly distributed, equal-size cracks that originate from the surface, the following conclusions can be made: (1) In a conventional, thermally stressed, solid fuel pellet, a radial crack initiated from a typical inherent radial flaw would propagate beyond the center of the fuel pellet. Further cracking considerations indicate additional radial cracks as well as circumferential cracks. (2) The presence of a central void or annulus stabilizes the crack at the hole. (3) The severe thermal environment in-reactor makes crack prevention impossible even if the surface flaw density and the fracture toughness are maximized. However, this approach will cause the ΔT necessary for crack propagation to be increased, allowing the possibility of thermal stress relaxation by plastic flow to inhibit crack propagation. The influence of plasticity on crack propagation was outside the scope of the present analysis. (6 figs.) (auth)

14554 DETERMINATION OF FRACTURE TOUGHNESS PARAMETERS FOR TUNGSTEN CARBIDE-COBALT ALLOYS. Lueth, R. C. (General Electric Co., Detroit). pp 791-806 of Fracture Mechanics of Ceramics. Vol. 2. Bradt, R. C. (Ed.). New York; Plenum Publishing Corp. (1974).

From conference of fracture mechanics of ceramics; University Park, Pennsylvania, USA (11 Jul 1973). See CONF-730707-P2; ISBN-0-306-37592-3(Vol.2).

Fracture toughness parameters for nine tungsten carbide cobalt alloys have been determined. These alloys range in cobalt content from 3 to 15 wt % and from 1.5 to 8 microns in tungsten carbide grain size. The fracture toughness of tungsten carbide cobalt alloys was found to depend strongly on binder film thickness such that generally the thicker the binder film, the higher the fracture toughness. The strength in bending of tungsten carbide cobalt alloys

has been found to depend on the yield strength, nominal flaw size, and fracture toughness of the material. (7 figs.) (auth)

14555 NATURE OF THE EVAPORATION OF TRANSITION-METAL CARBIDES. Bolgar, A. S. pp 142-146 of Teplofizicheskie svoistva tverdykh veshchestv. Samsonov, G. V. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian).

Available experimental data on the nature and rate of evaporation, and on the vapor pressure of transition-metal carbides at temperatures up to 3500°K are reviewed and generalized. The author's results on the evaporation characteristics of titanium, zirconium, hafnium, niobium, and tantalum carbides are tabulated. (IAA)

14556 CER-VIT DEFORMATION UNDER ELECTRON IRRADIATION. Bourrieau, J.; Romero, M. (Univ., Toulouse). pp 385-397 of Fourth Conference on Space Optics. Paris; Centre National d'Etudes Spatiales ([nd]). (In French).

From 4th conference on space optics; Marseille, France (6 Nov 1973).

Laboratory simulation, as far as the damage resulting from exposure to ionizing radiation is concerned, is very difficult to achieve. The methods used for tests on optical components sent into space are briefly discussed. A particular material, CER-VIT, which is used as a substrate for mirrors or gratings, is studied. The deformation caused by radiation is described as well as the influence of the different parameters (temperature, radiation energy and dose rate) which can vary depending upon the mission. The electronic irradiation results for the primary mirror of METEOSAT are indicated. (FR)

Metals and Alloys

Refer also to abstracts 14509, 14512, and 15619.

Corrosion and Erosion

Refer also to abstract 15614.

14557 (AD-782534) PROTECTION OF HIGH-MELTING METALS AND ALLOYS FROM DIFFUSION SETTING WITH HIGH TEMPERATURES AND LOADS. Burykina, A. L.; Gubenko, B. G. Translated by F. C. Vaughn from Zashch. Pokrytiya Metal.; No. 6, 180-184(1972). 15p. (FTD-MT-24-1343-74). NTIS $3.00.

This article investigates the adhesive interaction of certain alloys of high-melting metals (molybdenum, niobium, and tantalum) in a neutral medium 1300-1500°C under a 5 kgf/mm² load both in the initial state and after the application of protective coatings. Specific materials were carbides, borides, and nitrides. (GRA)

14558 (ORNL-tr-2886) ROLE OF THERMOPILES IN CORROSION PHENOMENONS IN A MOLTEN SALT. Jarny, P. Dec 1973. Translated by Martha Gerrard from the French. 10p. Dep. NTIS $4.00.

Following a general study on corrosion caused by a temperature gradient in a molten salt medium, the mass transfer of Fe, Ni, and Cr was studied by means of a thermopile: $M/MCl_2(X)$ (480°C)−LiCl-KCl (eut)/M(580°C), where X = mole fraction of solute and M = Fe, Ni, or Cr. The current discharged by the thermopile circulates, in the electrolyte, from the hot electrode to the cold. In the case of Fe and Ni, the current varies little with the concentration and with time. It is essentially proportional to ΔT for $T \leq 50°C$. The number of coulombs passing through the cell after a given time permits the calculation of the weight loss and gain (theoretical) of the electrodes. In most cases, these variations correspond rather well to those found by experiment. A micrographic study also furnished details of the anode corrosion. (9 fig) (auth)

14559 (SAND-74-8503) CORROSION BEHAVIOR, MECHANICAL PROPERTIES, AND LONG-TERM AGING OF NICKEL-PLATED URANIUM. Dini, J. W.; Johnson, H. R.; Schoenfelder, C. W. (Sandia Labs., Livermore, Calif. (USA)). Dec 1974. Contract AT(29-1)-789. 24p. Dep. NTIS $4.25.

The behavior of nickel-plated uranium upon exposure to moist nitrogen was evaluated. Plating thicknesses of 0.051 mm (2 mils) were adequate to prevent corrosion. Specimens with thinner coats showed some corrosion and some reduction in mechanical properties during subsequent testing. Plated samples exposed to dry air at ambient pressure for 10 years showed no corrosion and no degradation of mechanical properties. Surface and bulk hydrogen content, as well as free hydrogen generated during the test, were measured to determine the extent of corrosion. Results support an earlier proposed mechanism for uranium corrosion at low humidities. (5 figures) (auth)

14560 INTERNAL OXIDATION OF CERTAIN DOUBLE ALLOYS OF SILVER. Pravoverov, N. L. (All-Union Scientific-Research Inst. of Electromechanics, Moscow). Prot. Metals (USSR) (Engl. Transl.); 9: No. 6, 649-653(1973).

Translated from Zashch. Metal.; 9: No. 6, 728-732(1973).

Alloys studied were these of Ag with up to 4% Be, Mg, Pb, Zn, Zr, In, Y, or Mn. Zones of internal oxidation were measured and characterized. After oxidation, the hardness increases 2 to 2.5 times for Mg, Be, and Y additions. Kinetics and oxygen diffusion constants were measured. Effects of oxidation at 600 or 800° were determined. Two-phase alloys, like these with Zr or Y additions, have especially high strength. (DLC)

14561 DEPOSITION OF CHROMIUM, CHROMIUM−MOLYBDENUM, AND CHROMIUM−VANADIUM COATINGS BY THE DECOMPOSITION OF ORGANOMETALLIC COMPOUNDS. Petukhov, G. G.; Luzin, A. S.; Skuridina, P. N. (Gorky State Pedagogical Inst., USSR). Prot. Metals (USSR) (Engl. Transl.); 9: No. 6, 643-644(1973).

Translated from Zashch. Metal.; 9: No. 6, 722-723(1973).

Bis-ethylbenzene complexes of Cr, Mo, and V were used to apply coatings to steel parts. Carbonization of the coatings, which lead to brittleness, can be reduced if dibenzyl complexes are mixed with the ethylbenzene complexes. The resulting coatings do not peel upon bending and are highly corrosion resistant. The microhardness of Cr coatings is 1500 to 1800 Kg/mm², and addition of Mo or V increases it to 2100 to 2300 Kg/mm², with 2700 Kg/mm² being reached for Cr−Mo on a Ni-plated sample. (DLC)

14562 INVESTIGATION OF HEAT RESISTANT NICKEL COMPOSITIONS WITH RARE EARTH SESQUIOXIDES. Frolova, K. I.; Timoeeva, N. I. Prot. Metals (USSR) (Engl. Transl.); 9: No. 4, 435-436(1973).

Translated from Zashch. Metal.; 9: No. 4, 470-471(1973).

Effects of 10% addition of Gd_2O_3, Dy_2O_3, Er_2O_3, Tm_2O_3, or Lu_2O_3 on the oxidation of Ni in air at 800 to 1200°C were studied. Oxides of La, Nd, Sm, and Eu were also studied. (DLC)

14563 INFLUENCE OF THE NATURE OF THE ANIONS OF THE ELECTROLYTE ON THE ANODIC DISSOLUTION OF BERYLLIUM. Davydov, A. D.; Kashcheev, V. D.; Kozlov, M. V. (Inst. of Electrochemistry, Moscow). Prot. Metals (USSR) (Engl. Transl.); 9: No. 4, 398-399(1973).

Translated from Zashch. Metal.; 9: No. 4, 436(1973).

Anodic potentiodynamic polarization curves were obtained on a rotating Be disc electrode. The anions, in their effect on the potential, take the following order: Cl^-, Br^-, I^-, ClO_4^-, ClO_3^-, SO_4^{2-}, NO_3^-. (DLC)

14564 EFFECT OF THE OXIDATION CONDITIONS OF ZIRCONIUM ON THE STRUCTURE AND COMPOSITION OF SCALE. Opara, B. K.; Fokin, M. N.; Vtulkin, A. V.; Kravetskii, G. A.; Dergunova, V. S.; Tarabanov, A. S.; Zaikina, A. P. (Moscow Inst. of Steel and Alloys). Prot. Metals (USSR) (Engl. Transl.); 9: No. 4, 373-378(1973).

Translated from Zashch. Metal.; 9: No. 4, 407-414(1973).

A study was made of changes in the structure and composition of an oxide film on Zr during high-temperature (1200 to 1800°C) oxidation in air, O_2, and CO_2, and during subsequent annealing in Ar at these temperatures for 5 to 120 min. (DLC)

14565 ELECTROPHYSICAL CHARACTERISTICS OF ANODIC OXIDE FILMS ON BERYLLIUM. Vol'fson, A. I.; Markova, N. E.; Chernyshev, V. V.; Lebedev, V. N.; Vavakin, V. V. Prot. Metals (USSR) (Engl. Transl.); 9: No. 3, 321-322(1973).

Translated from Zashch. Metal.; 9: No. 3, 346-347(1973).

Be samples were degreased and oxidized in a 20% CrO_3 solution at 20 A/dm² and 20°C and the capacitance measured in the same solution. The anodic films had a thick porous external layer and a thin barrier layer on the metal side. From the capacitance reciprocal (C^{-1}) curve, the thickness of the barrier layer remains approximately constant over the formation course. For the porous layer, C^{-1} increases with anodization time. Breakdown voltage increases with film thickness. It is concluded that the anodic films on Be, formed in chromic acid, have great electrical strength. (DLC)

14566 CORROSION OF LANTHANUM UNDER ATMOSPHERIC CONDITIONS. Rybakov, B. N.; Moskvicheva, A. F.; Beregovaya, G. D. Prot. Metals (USSR) (Engl. Transl.); 9: No. 3, 278-280 (1973).

Translated from Zashch. Metal.; 9: No. 3, 303-306(1973).

Atmospheric corrosion and its products were investigated on cleaned La at different humidities and in the presence of corrosive gases (CO_2, H_2S, SO_2). The products are chiefly La hydrox-

ide, with some carbonate in the presence of corrosive gases. Kinetics were also studied. (DLC)

14567 CORROSION OF ZIRCONIUM IN MELTS OF METAPHOSPHORIC ACID AND SODIUM METAPHOSPHATE. Yut, M. K.; Polyak, E. A. Prot. Metals (USSR) (Engl. Transl.); 9: No. 3, 269-270(1973).

Translated from Zashch. Metal.; 9: No. 3, 295-297(1973).

The corrosion in glacial metaphosphoric acid was carried out at 600° and in sodium metaphosphate at 700°. The phase composition of the corrosion products was determined using x-ray diffraction. In metaphosphoric acid, corrosion is chiefly due to transfer of metal to the melt, while in sodium metaphosphate it is due to transfer of Zr both to the corrosion products and to the melt. (DLC)

14568 EFFECT OF SMALL ADMIXTURES OF TITANIUM, NIOBIUM, VANADIUM, AND MOLYBDENUM ON THE HYDROGEN RESISTANCE OF STEEL. Archakov, Yu. N.; Grebeshkova, N. D.; Zvezdin, Yu. I.; Kutyaev, V. M. (All-Union Scientific-Research Inst. of Petrochemical Processes, Moscow). Prot. Metals (USSR) (Engl. Transl.); 9: No. 3, 261-263(1973).

Translated from Zashch. Metal.; 9: No. 3, 288-290(1973).

The composition of the modified steel is 0.12% C, 0.34% Mn, 0.32% Si, 0.018% S, 0.013% P, 0.16% Ni, 0.29% Cr, 0.19% Mo, 0.14% V, 0.10% Nb, and 0.20% Ti. Phases present in this steel were analyzed and its mechanical properties compared with these of 15K and 12MK steels. The permissible temperature of safe operation of this steel under an omnidirectional or unidirectional H pressure of 300 kg/cm^2 is 500°C, as compared with 220°C for C steel, 330° for 0.5% Mo steel, etc. (DLC)

14569 OXYGEN FORMATIONS ON THE SURFACE OF LEAD, INDIUM, AND THEIR ALLOYS. Borshchevskii, A. M.; Baturova, L. P.; Skorchelletti, V. V. (Leningrad Polytechnic Inst.). Prot. Metals (USSR) (Engl. Transl.); 9: No. 3, 235-239(1973).

Translated from Zashch. Metal.; 9: No. 3, 257-263(1973).

Series of cathodic charging curves, recorded after ten-second polarizations at various specified potentials, are used in order to identify various oxygen-containing compounds developing on the surface of Pb, In, and Pb–In alloys during anodic polarization in dilute alkali. The mechanism underlying the formation of such compounds and their role in passivation processes are discussed, due allowance being made for the composition of the alloy and the easy diffusion of its components in the metallic phase. (4 figures) (auth)

14570 CONNECTION BETWEEN THE DIELECTRIC CONSTANT SOLVENTS AND THE CHARACTERISTICS OF CORROSION OF SOME METALS BY ALCOHOL–HCl SYSTEMS. Grigor'ev, V. P.; Ekilik, V. V.; Ekilik, G. N. (Rostov-on-Don State Univ., USSR). Prot. Metals (USSR) (Engl. Transl.); 9: No. 5, 528-531 (1973).

Translated from Zashch. Metal.; 9: No. 5, 594-598(1973).

The investigations were carried out on Fe, Ni, Cd, Zn, Al, Pb, Ti, and Cu in aqueous and alcoholic (C_1 to C_3) HCl solutions. Gravimetric and galvanostatic methods were used. The corrosion rate follows the equation log i = A–B/D, where A and B are constants and D is the dielectric constant. However, results for CH_3OH and 2N aqueous HCl solutions deviate from this equation. (DLC)

14571 INFRARED REFLECTANCE SPECTRA OF ANODIC OXIDE FILMS FORMED ON PURE NIOBIUM IN DILUTE PHOSPHORIC ACID. Takamura, T.; Kihara-Morishita, H. (Tokyo Shibaura Electric Co., Ltd., Kawasaki, Japan). Thin Solid Films; 24: No. 1, S7-S9(Nov 1974).

Thin rolled Nb plate (99.92% pure) was cleaned and anodic oxide formed at 1.0 mA/cm^2 10^{-2}N H_3PO_4 at 20°C. Infrared reflectance spectra of the oxide films at various anodization voltages show two broad bands in the 1200 to 700 cm^{-1} region. By curve resolution, two intense absorption bands and one weak one were observed with peaks at 935, 865, and 820 cm^{-1}. The constituent phases of anodic Nb oxide appear to grow linearly with thickness and to be composed both of amorphous oxide of near stoichiometry and of oxide doped with phosphorus. (DLC)

14572 INFLUENCE OF MOLYBDENUM ON THE RESISTANCE TO CORROSION BY PITTING AND CONTACT OF AUSTENITIC STAINLESS STEELS. Brigham, R. J. (Endako Mines, Ltd., Ottawa). Mater. Tech.; 62: 127-135(1974). (In French).

14573 MECHANISM OF THE INFLUENCE OF ADDITIONS OF MOLYBDENUM ON THE RESISTANCE TO CORROSION OF AUSTENITIC STAINLESS STEELS. Defranoux, J. M. (Ugine Kuhlmann, Paris). Mater. Tech.; 62: 137-143(1974). (In French).

14574 RESISTANCE OF CHROMIUM–NICKEL STEELS ALLOYED WITH MOLYBDENUM AND SILICON TO LOCAL CORROSION. Glazkova, S. A.; Shvarts, G. L.; Freiman, L. I.; Tavadze, F. N. (Scientific-Research Inst. of Chemical Machine Construction, Tbilisi, USSR). Prot. Metals (USSR) (Engl. Transl.); 10: No. 1, 6-11(1974).

Translated from Zashch. Metal.; 10: No. 1, 9-16(1974).

Results are presented from a study of the resistance of austenitic stainless steels to pitting corrosion and corrosion cracking, with recommendations for the optimal composition of steel 03Kh17N14M2S3. (5 figures, 4 tables) (auth)

14575 EFFECT OF SOME SURFACE ACTIVE SUBSTANCES ON THE HYDROGENATION OF STEEL DURING CADMIUM PLATING USING A REVERSE CURRENT. Beloglazov, S. M.; Siling, N. N. (Kalingrad Univ., USSR). Prot. Metals (USSR)(Engl. Transl.); 10: No. 1, 88-89(1974).

Translated from Zashch. Metal.; 10: No. 1, 93-94(1974).

A study was made of the effect of surface-active substances (OP-10, coumarin, p-chloroaniline, anisaldehyde, and secondary alkyl sulfates of olefins), reversal of current, and current density on the hydridation of steel U8A during Cd plating. The amount of hydridation was measured via retention of the ductility. (DLC)

14576 EFFECT OF A BARRIER LAYER OF TUNGSTEN ON DIFFUSION OF SILICON FROM DISILICIDE COATINGS INTO NIOBIUM. L'vov, V. S.; Sosul'nikova, M. A.; Chichkova, T. M. (Metallurgical Inst., Novosibirsk, USSR). Prot. Metals (USSR) (Engl. Transl.); 10: No. 1, 84-85(1974).

Translated from Zashch. Metal.; 10: No. 1, 89-90(1974).

Nb was coated first with W by reduction of WCl_6 vapors, and then with Si by gas thermodiffusion. The coating was analyzed using microstructure and x rays; results show that the upper layer consists of WSi_2 and that the lower layer next to Nb consists of $NbSi_2$. The influence of W is shown to lower the diffusion coefficient of Si by almost an order of magnitude and thus increases the heat resistance. (DLC)

14577 ELECTROCHEMICAL BEHAVIOR OF OXIDES ON Ti–Al AND Ti–Nb ALLOYS. Akimov, A. G.; Rozenfel'd, I. L. (Inst. of Physical Chemistry, Moscow). Prot. Metals (USSR) (Engl. Transl.); 10: No. 1, 26-29(1974).

Translated from Zashch. Metal.; 10: No. 1, 33-36(1974).

Surface oxides on Ti containing up to 10% Al or 20% Nb were investigated by electroabsorption and passivation measurements in alkaline solution. Electroabsorption spectra were measured at light quantum energies of 3.2 to 4 eV. Inflections in the passivation were due to the rutile–anatase phase transition in the oxide. (DLC)

14578 OXIDATION OF Nb–Re AND Nb–W SINGLE CRYSTALS AND POLYCRYSTALS BETWEEN 500 AND 1100°C. Taylor, A.; Stringer, J. (Univ. of Liverpool). J. Less-Common Metals; 39: No. 1, 109-141(Jan 1975).

Single crystals of Nb–1.5 and 3.5 at. % Re alloys were oxidized in dry oxygen 500 to 1000°C. Single crystals and polycrystals of Nb–1.5 and 3.5 at. % W alloys were also oxidized in dry oxygen 500 to 1100°C. Over the whole temperature range studied, W additions reduce the oxidation rate of pure Nb; Re additions also reduce the rate, but only below 650°C. In both cases, the greater the addition of alloying element, the more marked is the decrease in rate. In the oxidation of pure Nb, suboxide platelets, anisotropic scale-failures, and a transition to breakaway kinetics are only observed below about 625°C. Re additions effectively reduce the time to breakaway by at least two orders of magnitude. Re additions also appear to reduce the dynamic stability of suboxide platelets, and to produce unusual anisotropic scale-failures on oxidized single crystals. Rhenium seems to dissolve in Nb_2O_5 to produce a more "plastic" and adherent scale. At higher oxidation temperatures, Re is probably removed by the volatilization of Re_2O_7 and the oxidation rates of the alloys approach that for pure Nb. W additions also reduce the tendency for breakaway oxidation, but at these alloying levels, the effect is not as marked as with Re additions. Below 640°C, platelets are dynamically stable below {110} planes on Nb–W alloys but grow with habit selection, forming parallel to only one of the possible {100} planes in a given region of the specimen. Although the final morphology of breakaway oxidation is similar to that found in pure Nb, the formation of slightly smaller platelets and their non-intersection until oxidation has continued for some time provide an explanation for the longer induction periods before breakaway. At temperatures above 640°C, platelets are also observed on Nb–W alloys after oxidation and in some cases scale features indicate that they may be isothermal; the evidence on this point is not as good as with platelet-induced porosity observed at lower temperatures. (24 fig, 20 references) (auth)

14579 OXIDATION OF Nb–Ta SINGLE CRYSTALS AND POLYCRYSTALS IN THE TEMPERATURE RANGE 500 TO 1100°C.

Taylor, A.; Stringer, J. (Univ. of Liverpool). J. Less-Common Metals; 39: No. 1, 143-159(Jan 1975).

Four Nb–Ta alloys containing 4, 11.7, 21.5, and 47 at. % Ta were oxidized at 540 to 1100°C in oxygen at approximately 700 torr. Ta extends the "dynamic stability" of the metastable suboxide NbO_2 to higher temperatures, and this has the effect of extending the breakaway oxidation to higher temperatures. In pure Nb, breakaway is associated with the penetration of pentoxide into the metal along the suboxide platelets, isolating fragments of metal; in the alloys, cracking along the platelets also occurs and may become the more important breakaway mechanism. At any given temperature, the breakaway time increases with increasing Ta content. The scale lamination thickness diminishes slightly with increasing Ta content, but the pre-breakaway rate, nevertheless, is markedly reduced by increasing tantalum. Ta increases the temperature at which the high-temperature modification of Nb_2O_5 is formed, but there seems little change in the temperature at which the high-temperature, nonlinear oxidation process occurs, although in the pure metal these two changes have been linked. (14 fig) (auth)

14580 OXIDABILITY OF TITANIUM–TUNGSTEN AND TITANIUM–ALUMINIUM ALLOY SYSTEMS. Kornilova, Z. I.; Lazarev, Eh. M.; Kornilov, I. I.; Nartova, T. T.; Olejnikova, S. V. (AN SSSR, Moscow, Inst. Metallurgii). Dokl. Akad. Nauk SSSR; 215: No. 5, 1179-1181(11 Apr 1974). (In Russian).

The results of a study of the kinetics of the oxidation and phase composition of scales of alloys of the Ti–W system and of two cross sections of the Ti–W–Al system with 20% W were reported. The alloys were oxidized at temperatures of 600, 800, 900, and 1000°C. The study showed that W significantly increases the heat resistance of Ti and its alloys and offers the possibility of their use in operating temperature of 800 to 900°. (INIS)

14581 INVESTIGATION INTO HIGH-TEMPERATURE ZIRCONIUM OXIDATION WITHIN THE BOUNDS OF THE ELECTROCHEMICAL MODEL TAKING INTO ACCOUNT OF POLARIZATION PHENOMENA. Opara, B. K.; Fokin, M. N.; Vtulkin, A. V.; Kravetskij, G. A. (Moskovskij Inst. Stali i Splavov (USSR)). Dokl. Akad. Nauk SSSR; 214: No. 6, 1350-1353(21 Feb 1974). (In Russian).

For English translation see the journal Dokl. Phys. Chem.

On the basis of a comparison of the rate of "normal" oxidation and oxidation at the contact of the metal–oxide film division line and the oxide film–gas division line of current measuring devices with low internal resistance, attempts were made to determine the ion and electron resistance of oxide films during their growth and applied to the oxidation of Zr in O_2 at 1400°C. (INIS)

14582 ANISOTROPY OF THE OXIDATION OF Ta SINGLE CRYSTALS. Matuyama, T. (Defense Academy, Yokosuka, Japan); Dohi, S.; Aono, K.; Takabayashi, S. pp 112-115 of Japan Congress on Materials Research. Kyoto; Society of Materials Science (1974).

From 17th Japan congress on materials research; Tokyo, Japan (Sep 1973).

Anisotropy of the oxidation rate in air on three kinds of tantalum single crystal ingots with the top surface parallel to the three principal crystallographic surfaces was experimentally studied. Oxidation rate can be divided into three temperature stages: 600–800°C (stage I), 800–1,000°C (stage II), and 1,000–1,150°C (stage III). In stage I, oxidation rate is small and remains constant, and the order of oxidation rate for the various crystal planes, in decreasing order, is (111), (110), (100). In stage II, oxidation rate is approximately proportional to temperature, and order of oxidation rate is (110), (111), (100). At stage III, oxidation rate increases rapidly with increasing temperature, and order of oxidation rate is (111), (100), (110). Activation energies in stage II and III were anisotropic; at high temperatures, activation energies depend considerably on packing density of atoms in the surface. (IAA)

14583 NITRIDING OF Fe–5 wt % Mo. Hayes, P.; Grieveson, P. (Univ. of Strathclyde, Glasgow). Scr. Met.; 9: No. 1, 39-50 (Jan 1975).

Using purified 5% NH_3–95% H_2 at 580°C, the kinetics of nitriding of Fe–5 wt % Mo is best described by internal nitriding theory. With increasing nitrogen potential or oxygen potential, the nitriding behavior is readily interpreted in terms of nitrogen solute concentration profiles predicted by diffusion theory. The composition of the initial solute atom clusters formed on nitrided Fe–Mo alloys is dependent on the reaction temperature and time and the oxygen and nitrogen potentials of the gas atmosphere. (auth)

14584 BREAKAWAY OXIDATION OF ZIRCONIUM AND ITS ALLOYS: A REVIEW. Ahmed, T. (South Australian Inst. of Tech., Whyalla); Keys, L. H. J. Less-Common Metals; 39: No. 1, 99-107(Jan 1975).

"Breakaway" is one of the most prominent features of the oxidation of zirconium and its alloys. Although an impressive amount of work on zirconium oxidation has been carried out in recent years, there seems to be still a great deal of confusion as to the exact cause of "breakaway". The various current hypotheses on "breakaway" as well as the various factors affecting the phenomenon are critically examined in this review. (43 references) (auth)

Preparation and Fabrication

Refer also to abstracts 14095, 14518, and 14805.

14585 (BNL-19277) FABRICATION AND PROPERTIES OF Nb_3Sn SUPERCONDUCTORS BY THE SOLID DIFFUSION PROCESS. Suenaga, M.; Sampson, W. B.; Klamut, C. J. (Brookhaven National Lab., Upton, N. Y. (USA)). 30 Sep 1974. 7p. (CONF-740957-24). Dep. NTIS $4.00.

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974).

It has been demonstrated that the superconducting compound Nb_3Sn can be produced at the interface of Nb and a Cu–Sn alloy when the composite is heat treated at the proper reaction temperature. This method of Nb_3Sn preparation was also shown to be particularly suited to the fabrication of (a) Nb_3Sn multifilamentary composite wires for dc and low-frequency applications and (b) low ac loss Nb_3Sn tapes for 60-Hz applications. The fabrication method and superconducting properties of Nb_3Sn composite conductors made by this process are reviewed and the metallurgical aspects of the process are discussed. Since practical applications of these composites requires large, high-current conductors, methods of producing compound conductors such as cables and braided ribbons which include strenghening and stabilizing components are also discussed and some preliminary results of high-current conductors are presented. (auth)

14586 (BNL-tr-585) PROPERTIES OF MULTIFILAMENT SUPERCONDUCTING Nb_3Sn AND V_3Ga WIRES. Nikulin, A. D.; Fil'kin, V. Ya.; Chernoplekov, N. A.; Kovaleva, V. A.; Klimenko, E. Yu. Translated by S. J. Amoretty from Tsvetn. Metal.; No. 9, 62-63(1974). 10p. Dep. NTIS $4.00.

A diffusion process for making multifilamentary Nb_3Sn and V_3Ga composite wires was developed. It comprises inserting Nb and V rods into a Cu–Sn and Cu–Ga matrix respectively and reducing the composite billet to 0.2 to 0.4 mm dia; the wire is then twisted. After heat treatment, the Sn or Ga reacts with Nb or V to produce Nb_3Sn or V_3Ga filaments. Diffusion rates of Sn and Ga through Nb_3Sn and V_3Ga were calculated. Critical currents and density, critical fields, and superconducting transitions were measured. (DLC)

14587 (CEA-N-1733) PREPARATION OF SELF-SUPPORTING METAL FOILS OF CHROMIUM ISOTOPES. Mahut, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91— Gif-sur-yvette (France). Dept. de Physique Nucleaire). Jun 1974. 13p. (In French). Dep. NTIS (US Sales Only) $4.00.

Chromium foils of the isotopes ^{50}Cr and ^{54}Cr were prepared by electrolytic deposition to make self-supporting targets for electron scattering (e,e') experiments. The thickness of these foils can reach 45 mg/cm^2 with a high degree of purity and homogeneity. The great advantage of this procedure is that the cost of production is reduced to a minimum. For a sample of nonmiscible Cr_2O_3 borrowed from ORNL, the necessary amount of chromium is extracted by electrolysis and the remaining part of the Cr_2Cr_3 sample is returned to ORNL. (FR)

14588 (INR-1432/14/R) SPHEROIDIZATION OF METALLIC AND CERAMIC POWDERS IN PLASMA TORCH. Rutkowski, W.; Szteke, W. (Institute of Nuclear Research, Warsaw (Poland)). 1972. 12p. INIS.

From Polish–Italian seminar on some chemical, ceramic, and metallurgical aspects of nuclear fuels; Zakopane, Poland (29 May 1970).

The application of a plasma torch for spheroidization of Ni, Ta, and corundum powders was examined. Results of spheroidization of different sorts of powders, as well as the results of metallographic examination of the aforementioned powders before and after spheroidization processes are presented. (auth)

14589 APPLICATION OF REFRACTORY METAL COATINGS BY FUSED SALT ELECTROLYSIS. Antonov, S. P.; Ivanovskii, L. E.; Petenev, O. S. (Ural Scientific Center, Sverdlovsk, USSR). Prot. Metals (USSR) (Engl. Transl.); 9: No. 5, 500-504(1973).

Translated from Zashch. Metal.; 9: No. 5, 567-571(1973).

Data on the electrodeposition of some refractory metals and their alloys are tabulated: Ti, Zr, ZrB_2, Zr–Al, Zr–Ti, Hf, V,

Nb, Ta, Cr, Mo, Mo–Ni, and W. The most important factors in the deposition are the temperature and the valence. (38 references) (DLC)

14590 STRUCTURAL AND ELECTRICAL PROPERTIES OF Ta AND Ta NITRIDES DEPOSITED BY CHEMICAL VAPOR DEPOSITION. Hieber, K. (Siemens AG, Munich). Thin Solid Films; 24: No. 1, 157-164(Nov 1974).

It is shown that single-phase α-Ta, β-Ta, Ta_2N, TaN(fcc) and Ta_3N_5 films can be produced by chemical vapour deposition (CVD). The structure of the microcrystalline deposits was investigated by transmission electron microscopy. Electrical measurements reveal that the resistivities of CVD films are comparable with those of sputtered films. However, the temperature coefficient of resistivity (TCR) of β-Ta, Ta_2N, and TaN(fcc) is positive, varying between 30 and 300 ppM/°K. In the case of Ta_3N_5, the TCR is negative ($\alpha \sim -40{,}000$ ppM/°K) and the resistivity has a value of about 6 Ω cm. (15 figures) (auth)

14591 GROWTH OF SINGLE CRYSTALS OF CUBIC LAVES PHASE COMPOUNDS IN THE Ho–Tb–Fe SYSTEM. Milstein, J. B.; Koon, N. C.; Johnson, L. R.; Williams, C. M. (Naval Research Lab., Washington, DC). Mater. Res. Bull.; 9: No. 12, 1617-1622(Dec 1974).

Preparation of large single crystal specimens of $HO_{1-x}Tb_xFe_2$, where x = 0.12 to 0.18, from 1% rare-earth-rich melts by the Czochralski technique using an electric-arc furnace is described. X-ray, magnetic anisotropy, and neutron diffraction data demonstrate that crystals of excellent quality were obtained. (auth)

14592 VACUUM BRAZING TANTALUM ALLOYS. Rupert, E. J.; Meyer, M. W.; Uhland, G. E. (to Secretary of the Air Force). US Patent 3,846,903. 12 Nov 1974. Filed Date 13 Jul 1973. 10p.

A process is provided for fabricating a structure by vacuum brazing tantalum alloy elements. A Nb–V brazing foil is placed between surfaces of the elements to be joined. A coating of yttria powder is applied to surfaces of elements that will be in contact with a tungsten hearth plate and tungsten pellets. The structure is positioned on the tungsten hearth plate in a vacuum heating zone with tungsten pellets disposed on top of the portion of the upper element to be joined so as to exert pressure thereon and control the gap between the surfaces to be joined. The elements are heated under a vacuum in the vacuum heating zone to a temperature sufficient to melt the brazing foil. After soaking at that temperature for several minutes, the elements are gradually cooled to room temperature. The vacuum brazing process is particularly suitable for use in fabricating honeycomb sandwich panels. (Official Gazette)

14593 QUANTITATIVE EVALUATION OF THE EFFECT OF ALLOYING ELEMENTS ON PORE FORMATION IN WELDING NICKEL ALLOYS. Sorokin, L. I.; Golubev, A. I. Avtomat. Svarka; No. 7, 70-71(Jul 1974). (In Russian).

The content of Nb, Re, Mn, Ti, and Al in nickel alloys was correlated to their tendency to pore formation to partial pressure of nitrogen in the argon gas shield. It was found that the tendency of the seam metal to pore formation is increased with increased nitrogen partial pressure but is lowered if the nickel alloys have Cr, Nb, Ti, Mn, and Re added. It was assumed that the positive effect of the alloying elements on porosity suppression is associated with the increased solubility of nitrogen in the molten metal although no quantitative relationship between the solubility of nitrogen in nickel and effectiveness of porosity suppression by alloying was established. (JPRS)

14594 IMPROVED MANUFACTURING METHODS SEEN AS KEY TO LOWER COST BORON–ALUMINUM COMPOSITES. Mater. Eng.; 78: No. 4, 46-47(Apr 1974).

With improved manufacturing methods the price of boron-aluminum composite structures will be markedly reduced. Also, continuing reductions in the price of boron filaments will contribute to lower cost boron–aluminum. (7 figures) (auth)

14595 LASER CUTTING OF AEROSPACE MATERIALS. Trink, S. Technical Paper No. EM73-214. Dearborn, MI; Society of Manufacturing Engineers (1973). 21p.

Optimization of laser cutting parameters, identification of appropriate secondary edge finishing operations, equipment features and requirements, as well as economic savings of laser cutting relative to conventional aerospace cutting methods, are discussed. Materials were Ti–6Al–6V–2Sn alloys, 4340 and 4140 steels, 321 stainless steels, PVC, Plexiglas, B–Al green tape and B tape. Principal operating parameters of the numerical contouring control CO_2 laser involved energy density, lens characteristics, gas-jet-assist related parameters and carriage feed rate. It was demonstrated that laser cutting speed was 10 to 40 times faster than alternative methods; no cutting forces were generated, thereby minimizing supportive tooling; and operating costs were low. Post-cutting treatments, sanding, chemical etching and conventional milling showed no degradation effects on tensile and fatigue properties. It is recommended that the HAZ be removed during secondary finishing operations. (Metals Abstr.)

14596 THE EFFECT OF THE USE OF Al–Mg ALLOYS IN OBTAINING FUEL ELEMENTS WITH A CORE OF Al–U–Si ALLOY. Iervolino, J. R.; Cintra, S. H. L. (Instituto de Energia Atomica, Sao Paulo (Brazil). Divisao de Metalurgia Nuclear). Metalurgia (Sao Paulo); 27: No. 158, 31-36(Jan 1971). (In Portuguese).

From 25th annual meeting of the Brazilian association of metals; Porto Alegre, Brazil (Jun 1970).

The effect of the use of Al–Mg alloys in obtaining fuel elements for research reactors with a core of Al–U–Si alloy is studied. The factors which affect the form of the end zone is discussed and the appearance of defects in this zone as a consequence of the difference in mechanical properties of the alloys used in the assembly is recognized. By means of a comparative experimental study, the adoption of 5052 Al Alloy, with a core not treated isothermically, leads to satisfactory results. (INIS)

14597 THERMODYNAMICS OF REDUCTION OF ALUMINUM TUNGSTATE AND MOLYBDATE. Burykhina, S. V.; Kozlovskii, L. V.; Yadin, B. F. (Leningrad Technological Inst.). Inorg. Mater. (USSR) (Engl. Transl.); 10: No. 6, 902-905(Jun 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 6, 1050-1053(Jun 1974).

Comparative calculation methods were used to determine the standard enthalpies of formation and entropies of Al molybdate and tungstate. Thermodynamic analysis was used to determine the possibility of reduction of Al molybdate and tungstate with formation of pure metal (Mo or W) and Al_2O_3. Results of experimental investigations in the range 1073–1373°K agree closely with the thermodynamic calculation. (auth)

14598 ELECTROSLAG REMELTING OF TYPE 316 STAINLESS STEEL. Anable, W. E.; Nafziger, R. H.; Robinson, D. C. (Bureau of Mines, Albany, OR). J. Metals; 25: No. 11, 55-61 (Nov 1973).

Two groups of Type 316 stainless steel ingots were electroslag remelted for ultimate conversion to tubing for tests associated with the LMFBR. The reduction in imperfections achieved suggests electroslag remelting as a promising alternative to vacuum arc or vacuum induction melting. (6 tables, 4 figs.) (auth)

Properties, Structure, and Phase Studies

Refer also to abstracts 15284, 15287, 15288, 15291, 15617, and 15625.

14599 (AD-783288) RELATIONSHIP OF COMPOSITION AND STRUCTURE TO STRENGTH IN TITANIUM ALLOYS. Final Report, 1 May 1969–28 February 1972. Breedis, J. F. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Metallurgy and Materials Science). May 1974. Contract F33615-69-C-1603. 116p. (AFML-TR-73-77). NTIS $4.50.

The strengthening of beta-phase alloys by precipitation, alloying with an interstitial solute, and grain refinement was examined. Also considered are the factors which influence the transition from slip to mechanical twinning as the dominant deformation mode. With regard to precipitation strengthening, omega-phase formation was examined in titanium–vanadium and the possibility of spinodal decomposition was studied in ternary titanium–niobium–metal alloys. With regard to the influence of interstitial solute and grain refinement on mechanical properties, the influence of oxygen, at three levels of oxygen equivalent, was studied in titanium-18 at.% molybdenum–oxygen alloys. Grain sizes were also varied by an order of magnitude to examine the Hall–Petch relationship. (GRA)

14600 (AD-784261) EFFECT OF ADDITIONAL ALLOYING ON THE PROPERTIES OF THE ALLOYS OF THE Mg–Li–Al SYSTEM. Drits, M. E.; Sviderskaya, Z. A. Translated from Izv. Vyssh. Ucheb. Zaved., Tsvet. Met.; No. 1, 120-124(1967). 12p. (FTD-HC-23-1785-74). NTIS $3.00.

Effects of alloying Mg + 5% Li + 5% Al with small additions of Zn, Mn, Ag, Cd, Ni, Ca, Ce, La, Nd, and Y on the mechanical properties were studied in heat-compressed conditions after keeping them at 100°C for 100 h, and at room temperature for 6 months. This made it possible to evaluate the stability. Microstructure is discussed. (GRA)

14601 (AD-785534) TYPE II FILM SUPERCONDUCTORS FOR POWER APPLICATIONS. Report for October 1969–July

1973. Spitzer, H. J. (Army Mobility Equipment Research and Development Center, Fort Belvoir, Va. (USA)). May 1974. 39p. (USAMERDC-2101). NTIS $3.25.

A basic theoretical background of type-II superconductors and an introduction into materials are presented. Requirements for these materials for army power applications are analyzed and compared with present availability. A series of solid-solution alloy systems was investigated, namely Nb–Zr, Nb–Ti, Nb–Ta, Ti–V, Nb–V, and Ta–Ti. In addition, a few compound systems were examined, namely niobium nitride, niobium carbide, and the solid solution of substitution compound system of niobium nitride-carbide. Also, work was initiated on intermetallic compounds, namely Nb–Al, Nb–Ge, and Nb–Ga. (GRA)

14602 (CEA-CONF-2606) INFLUENCE OF THE FABRICATION CONDITIONS IN THE MECHANICAL PROPERTIES AND PARTICULARLY ON THE CREEP RESISTANCE OF ZIRCALOY CLADDINGS. Frenkel, J. M. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Technologie). 1974. 18p. (In French). (CONF-740350-1). Dep. NTIS (US Sales Only) $4.00.

From mechanical and metallurgical colloquium; Tarbes, France (7 Mar 1974).

Two classical examples from literature show the effect of texture on mechanical properties of Zircaloy sheets and tubes. CEA studies on factors affecting the creep resistance of Zircaloy claddings are then reported. The resistance to transverse creep increases very sharply with the final annealing temperature. The resistance to longitudinal creep decreases with annealing temperature. It is concluded that the texture responsible for the anisotropy evolves with the annealing conditions. The final cold-working rate is also an important parameter as results show that the resistance to transverse creep is much better when the cold working rate is low. The effect of cold working on longitudinal creep in general disappears only when thermal treatments cause total recrystallization. (14 fig) (JSR)

14603 (CEA-R-4640) ANALYSIS OF THE M_{IV-V} ABSORPTION SPECTRA OF PLUTONIUM IN THE DELTA PHASE. Courtois, A. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Etudes des Combustibles a Base de Plutonium). Dec 1974. 72p. (In French). Dep. NTIS (US Sales Only) $6.75.

Thesis.

X-ray absorption spectroscopy provides information on the electronic structure of plutonium in the δ phase, and in particular the 5f states. The M_{IV-V} absorption spectra which is associated with the inner $3d_{\frac{5}{2}}$ and $3d_{\frac{3}{2}}$ levels was studied. According to the selection rules, strong absorption lines must occur for a 3d electron excited to an f state. The spectra reveal a weakening of the absorption discontinuity, a narrowing of the absorption line, and a shift in the peak of the line of about 1 eV. From these results it follows that the unoccupied f states have a more marked atomic character in δ-Pu than in α-Pu leading to move localized 5f electrons in each ion of the F. C. C. δ-Pu phase. The transformation of orthorhombic γ Pu to F. C. C. δ Pu is accompanied by an increase in volume which indicates a 6 d $\rightarrow$ 5 f transition. The results are in good agreement with the hypothesis which suggests the existence of active interstitials in the self diffusion process of the ϵ phase. Indeed the transformation of δ-Pu (F. C. C.) $\rightarrow$ ϵ Pu (B. C. C.) is accompanied by a volume contraction implying a 5 f $\rightarrow$ 6 d reverse transition leading to a smaller ionic radius and an easier access of atoms in the interstitial sites of the crystal lattice. (auth)

14604 (COO-3394-4) CALORIMETRIC STUDIES ON SUPERCONDUCTORS. Final Report, June 1, 1968–November 30, 1972. Shiffman, C. A.; Neighbor, J. E. (Northeastern Univ., Boston, Mass. (USA)). 1972. Contract AT(11-1)-3394. 109p. Dep. NTIS $8.50.

Accurate calorimetric techniques were applied to the study of the proximity effect in lamellar Pb–Sn eutectic alloys, and to the study of strong-coupling and type II superconductivity of Pb–In and supersaturated, single-phase Pb–Sn alloys. (Some work on the Pb–Bi system is also reported.) Results are given for the free energy differences, specific heats, equivalent surface energies, and transition temperatures for the proximity effect, for domain dimensions spanning the range from the very thick to the very thin limits, and for the electronic specific heat coefficients, Debye temperatures, thermodynamic critical fields, and generalized Ginzburg–Landau parameters for the single-phase alloys. (23 fig, 6 tables, 50 references) (auth)

14605 (FOA-4-C-4547) MAGNETISM AND THE LANTHANIDES. Hohansson, B.; Rosengren, A. (Foersvarets Forskningsanstalt, Stockholm (Sweden)). Jul 1973. 73p. (In Swedish). INIS.

This report gives an overall picture of the basic mechanisms for the magnetic properties of a material. Origins of the different types of magnetism are described, starting from the atomic exchange interaction. Special attenuation is given to the properties of the lanthanides. The rich flora of magnetic structure in these elements (ferromagnetic, paramagnetic, pseudo-ferromagnetic, pseudo-antiferromagnetic, ferrimagnetic, static spin wave and helix structure) is described and discussed from the point of view of atomic and crystal structure. Some notes are given on the technological applications of the lanthanides, viz., Welsbach gas mantles, permanent magnets (e.g. Co_5Sm), magnetic bubbles, lasers, photochromics and in the steel industry (small additions to improve the quality of steel). (INIS)

14606 (INIS-mf-1353) INTERNAL FRICTION IN RHENIUM. Callens-Raedschelders, M. (Rijksuniversitair Centrum te Antwerpen (Belgium)). 1974. 129p. INIS.

Thesis.

Internal friction spectra of polycrystalline hcp Re specimens show a relaxation peak, which is attributed to double-kink generation. The introduction of a relaxation peak and the decrease of the background damping, occurring as a result of ageing at room temperature, are interpreted in terms of dislocations moving, during ageing, from a position non-parallel with a Peierls valley, into a position in a Peierls valley and hence changing their behavior from string-like to double-kink generation conditioned. The behavior of the amplitude dependence too can be understood by taking account of the influence of double-kink generation. Whereas in the Granato–Luecke theory the amplitude dependence is interpreted in terms of a dislocation–point defect interaction model, it is suggested that the amplitude dependence is additionally influenced by an intrinsic dislocation property, namely the double-kink generation. From these amplitude-dependent measurements, the importance of the presence of internal stresses on the internal friction behavior of a Re specimen is shown. Moreover, an interpretation for the differences between the results on polycrystalline material and reported results on single crystals is given in terms of a different response to plastic deformation. Theoretical calculations were performed, concerning the atomistic aspects of the perfect and the dislocated lattice. (DLC)

14607 (INIS-mf-1393) LOCALIZED SPIN FLUCTUATIONS IN SOME DILUTE ALLOY SYSTEMS. van Dam, J. E. (Rijksuniversiteit Leiden (Netherlands)). 17 Jan 1973. 161p. INIS.

The static magnetic susceptibility of Au–V, Pd–Cr, and Pt–Cr alloys, and of pure Pd was measured from 2 to 293°K. The temperature dependence of the impurity susceptibility of the most dilute samples of the Au–V alloys (0.2 and 0.3 at. % V) can be described, for $T < 50$°K, by $\chi(T) = \chi(0)(1-AT^2)$. The magnetic susceptibility can be considered to arise from a virtual bound state having a width comparable to kT_K. Results for more concentrated alloys indicate the existence of V atoms with stronger and weaker local magnetic properties than isolated V atoms. In the low concentration regime ($c \lesssim 1$ at. % Cr) of the Pd–Cr and Pt–Cr alloys, the Cr atoms can be considered as nonmagnetic, while for higher concentrations a magnetic moment develops at the Cr sites. Properties of the Pd–Cr and Pd–Ni systems are computed; both systems can be described in terms of the local spin fluctuation model. The susceptibility of pure Pd was also measured for the analysis of the Pd–Cr measurements. The temperature dependence of χ is anomalous, exhibiting a broad maximum around 85°K in the χ versus T curve. The specific heat of some dilute Pd–Ni alloys was measured in order to check the suggestion that LSF effects would be at the origin of the anomalous temperature dependence of the effective Debye temperature. (auth)

14608 (INR-1433/14/PS) $\beta \rightarrow \alpha$ TRANSFORMATION IN AN U–0.4 wt % Cr ALLOY. Hofman, A. (Institute of Nuclear Research, Warsaw (Poland)). 1972. 14p. INIS.

From Polish–Italian seminar on some chemical, ceramic, and metallurgical aspects of nuclear fuels; Zakopane, Poland (29 May 1970).

The isothermal phase transformation at 640 to 400°C was investigated by dilatometric, metallographic, and x-ray analysis. C-curve for transformation was obtained. The possibilities of applying known kinetic equations for this transformation were analyzed. It was found that the $\beta \rightarrow \alpha$ transformation in U–0.4 wt % Cr alloy at 640 to 400°C occurs through two different mechanisms. The influence of annealing temperature in the β phase on the transformation rate was investigated. (auth)

14609 (WANL-TME-412) INVESTIGATION OF BERYLLIUM FRACTURE PROPERTIES IN ORDER TO PREDICT SAFETY MARGIN OF REACTOR COMPONENT. Kallin, I. N. (Westing-

house Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 19 Mar 1963. 26p. Dep. NTIS $4.50.

A thermal stress problem in beryllium at cryogenic temperature is analyzed for possible fracture and the safety factor is predicted. Round notched-bar tensile tests at −320°F and other temperatures up to 212°F are reported. Values of energy release rate G_0, are computed from the tests and used in the analysis. (auth)

14610 EXCESS ELECTRICAL CONDUCTIVITY DUE TO FLUCTUATIONS OF QUENCH-CONDENSED SUPERCONDUCTING Nb FILMS. Kawaguti, T.; Shibuya, Y. (Kyushu Univ., Fukuoka). J. Low Temp. Phys.; 17: No. 1-2, 143-157(Oct 1974).

The resistive transition of superconducting Nb films evaporated onto a liquid-He-cooled substrate has been investigated, and shows a rounding characteristic of the thermal fluctuations. Transition curves have been measured above and below the superconducting transition temperature T_c in the absence of a magnetic field. The excess electrical conductivity due to fluctuations above T_c of quench-condensed Nb films is well described in terms of the sum of the contributions from the Aslamazov–Larkin term and from the Maki–Thompson term, in contradistinction to the case of quench-condensed Bi, Ga, and Pb films. This suggests that thermal phonons play an important role in the contribution of the Maki term. (auth)

14611 THERMAL CONDUCTIVITY OF THE KONDO SUPERCONDUCTOR Zn–Mn. Sanchez, D. H. (Rutger—The State Univ., New Brunswick, NJ). J. Low Temp. Phys.; 17: No. 1-2, 101-120(Oct 1974).

The thermal conductivity in bulk samples of pure Zn and the Kondo alloy Zn–Mn have been measured in the temperature range 0.360 to about 1.0 K for concentrations 2.7, 6.0, 8.4, 10.0, and 11.7 ppM Mn. The results for the depression of the superconducting to normal state transition temperature (T_c) with Mn concentration and for the temperature dependence of the thermal conductivity of pure Zn agree with the results obtained by other workers. The ratio of the thermal conductances in the superconducting and normal states has been quantitatively compared with the Bardeen–Rickayzen–Tewordt and Ambegaokar–Griffin theories. Agreement was found between the Ambegaokar–Griffin theory and experiment at all temperatures for Mn concentrations lower than 10.0 ppM and discrepancy between theory and experiment in the 10.0 ppM and 11.7 ppM samples. In the latter specimens the measured conductance ratio was greater than the theoretical predictions. For these two samples T_c occurs at about the temperature where ordering (impurity–impurity interactions) is observed in the normal state. The measurements were analyzed using those solutions of the Kondo problem in superconductors dealing mainly with the existence of bound states in the energy gap, as well as available theories on the effects of impurity–impurity interactions. It was concluded that the results can be qualitatively understood using the ideas of Fowler and Maki and of Zittartz and Mueller–Hartmann which give a bound state in the energy gap. It appears that the growth of the impurity band and spin ordering (impurity–impurity interactions) are intrinsically related. (auth)

14612 SUPERCONDUCTING TRANSITION TEMPERATURE AND ITS HIGH-PRESSURE BEHAVIOR OF TETRAGONAL Nb_3Sn. Chu, C. W. (Cleveland State Univ.); Vieland, L. J. J. Low Temp. Phys.; 17: No. 1-2, 25-29(Oct 1974).

The superconducting transition temperature T_c of the tetragonal phase of a Nb_3Sn single crystal was determined calorimetrically to be 17.78 ± 0.02 K. It is suppressed by the application of hydrostatic pressure at a rate of $-(1.40 \pm 0.05) \times 10^{-5}$ K bar^{-1}. The previous observations of double superconducting transitions in Nb_3Sn and other A15 compounds are discussed. (auth)

14613 LOW-TEMPERATURE SPECIFIC HEAT OF Ti–Hf ALLOYS. Agarwal, K. L.; Betterton, J. O. Jr. (Univ. of New Orleans). J. Low Temp. Phys.; 17: No. 5-6, 515-519(Dec 1974).

The effect of alloying on the specific heat of Ti–Hf alloys has been investigated in the temperature range 1.2 to 4.5 K. A maximum is observed in the electronic specific heat coefficient γ around 35 at.% Ti and the Debye temperature θ_D decreases from titanium to hafnium. No superconductivity is found down to the lowest temperature studied. (auth)

14614 NATURE OF THE CHANGE IN THE CONDITIONS FOR SURMOUNTING PINNING CENTERS BY DISLOCATION IN LEAD AT THE SUPERCONDUCTING TRANSITION. Pal-Val, L. N.; Platkov, V. Ya. (Physico-Technical Inst. of Low Temperatures, Kharkov). J. Low Temp. Phys.; 17: No. 5-6, 497-507(Dec 1974).

The effect of the presence of Sb on the amplitude dependence of ultrasonic attenuation α in the concentration range 1.7×10^{-3} to 4.25×10^{-1} at.% has been studied systematically on Pb single crystals at 1.4 and 4.2 K (superconducting and normal states) and 77 K. The dependence curve shifts toward greater amplitudes U with increasing concentration C and to smaller U when T goes from 1.4 to 4.2 K. The shift toward greater U at the transition to the normal state is observed for all concentrations. The amplitude-independent attenuation α_i varies with concentration nonmonotonically: Increasing C causes α_i first to diminish (the minimum at C = 0.034 at.%) and then to grow. At C ≥ 0.034 at.%, α_i does not change at the n–s transition. The studies suggest that the damping factor for dislocations in impure crystals practically does not change at the superconducting transition. Here the damping is essentially due to the dynamic dislocation–impurity interaction. The change in the conditions for a dislocation surmounting the pinning centers at the superconducting transition is determined by the quasistatic mechanism of lowering barriers. (auth)

14615 THERMAL CONDUCTIVITY OF Ta–Nb ALLOYS IN SUPERCONDUCTING, MIXED, AND NORMAL STATES. Kobayashi, N.; Noto, K.; Ikebe, M.; Muto, Y. (Tohoku Univ., Sendai). J. Low Temp. Phys.; 17: No. 5-6, 575-594(Dec 1974).

The thermal conductivity of the type-II superconductors $Ta_{95}Nb_5$, $Ta_{80}Nb_{20}$, $Ta_{60}Nb_{40}$, and $Ta_{20}Nb_{80}$ has been measured as a function of magnetic field up to 14 kOe and of temperature between 0.5 and 4.5 K. The temperature dependence of the thermal conductivity in the superconducting state is well accounted for on the basis of the Bardeen, Rickayzen, and Tewordt theory above 0.4 T_c. The lattice thermal conductivity limited by dislocation scattering is observed below 0.3 T_c. The thermal conductivity near the upper critical field H_{c2} shows a linear dependence on magnetic field as predicted theoretically by Caroli and Cyrot. After the correction of the phonon contribution, the experimental results for the dirtiest sample, $Ta_{80}Nb_{20}$, are found in good quantitative agreement with the theory. Deviations for the theory for less dirty alloys depend on the electron mean free path. (auth)

14616 COLLECTIVE OSCILLATIONS OF THE ORDER PARAMETER AND ELECTROMAGNETIC RESPONSE IN NIOBIUM. Alexander, E. M. (Naval Research Lab., Washington, D. C. (USA)); Leibowitz, J. R. (Catholic Univ. of America, Washington, D. C. (USA). Dept. of Physics). Phys. Lett., A; 49: No. 6, 473-474(21 Oct 1974).

Caroli and Maki predict a strong anisotropy in the transverse electromagnetic response of pure type II superconductors due to the effect of transverse collective fluctuations of the order parameter. The predicted anisotropy in the transverse acoustic wave attenuation near H_{c2} was studied experimentally in niobium and found to be absent for q parallel to [100]. (INSPEC)

14617 CRYSTAL FIELD SPLITTING OF GADOLINIUM IN SINGLE CRYSTALS OF METALLIC LaBi. Urban, P.; Elschner, B.; Sperlich, G. (Technische Univ. Darmstadt (F.R. Germany)); Schoen, G. (Technische Univ. Darmstadt (F.R. Germany). Eduard-Zintl-Inst. fuer Anorganische und Physikalische Chemie). Phys. Lett., A; 49: No. 6, 418-420(21 Oct 1974).

Resolved fine structure has been observed in the ESR of Gd^{3+} in metallic LaBi single crystals. The parameter b_4 = +63.7 Oe characterizes a very large cubic crystal field splitting. The g factor of g = 2.002 is interpreted as evidence of s-f exchange interaction. (auth)

14618 THERMODYNAMIC INVESTIGATION OF SOLID SOLUTIONS INTO Fe–W SYSTEM RICH IN IRON. Bokshtejn, B. S.; Bronfin, M. B.; Zhukhovitskij, A. A.; Nikol'skij, G. S. (Moskovskij Inst. Stali i Splavov (USSR)). Dokl. Akad. Nauk SSSR; 215: No. 6, 1356-1359(21 Apr 1974). (In Russian).

This study deals with a thermodynamic investigation of dilute solid solutions in the Fe–W system by the method of Langmuir. The investigations were carried out on a unit designed for the sublimation metals from an open surface under conditions of high vacuum (10^{-6} mm Hg std) in the temperature interval of 950 to 1200°C. The chemical composition of the alloys was determined. The data indicate a stronger interaction of different atoms rather than atoms of the same kind, that is, there is a tendency to the occurrence of near order. It can be conceived that there are regions in the crystal where in the vicinity of the iron atoms the fraction of impurity atoms is greater, and that there exist regions in the crystal free of impurities. (tr-SJR)

14619 VELOCITY OF SOUND IN THE TIN–LEAD–CADMIUM TERNARY LIQUID SYSTEM. Rubtsov, A. S.; Stremousov, V. I. (Volgograd Pedagogic Inst., USSR). Russ. J. Phys. Chem. (Engl. Transl.); 48: No. 1, 29-30(Jan 1974).

Translated from Zh. Fiz. Khim.; 48: No. 1, 54-56(Jan 1974).

The dependence of the velocity of sound on the composition of the alloy and temperature was examined. The temperature de-

pendence of the velocity of sound is linear and the equal-velocity plots in the acoustic triangle consist of parallel straight lines. It is concluded that chemical compounds are absent from the tin–lead–cadmium liquid system. (auth)

14620 THERMODYNAMICS OF BINARY OXIDE COMPOUNDS AT ELEVATED TEMPERATURES. V. Application of the Electromotive Force Method in the Determination of the Thermodynamic Properties of Barium-Containing Compounds. Levitskii, V. A.; Skolis, Yu. Ya; Khekimov, Yu.; Shevchenko, N. N. (Moscow State Univ.). Russ. J. Phys. Chem. (Engl. Transl.); 48: No. 1, 24-27(Jan 1974).

Translated from Zh. Fiz. Khim.; 48: No. 1, 44-48(Jan 1974).

The possibility of applying the emf method to $[F^-]$-ionic electrolytes in cells of the type O_2, Pt $|\mu_1(BaO)|$ $F^-|\mu_2(BaO)|$Pt, O_2 in order to determine the thermodynamic parameters of reactions involving barium-containing oxide compounds was examined. Phase relations in the $BaO-ZrO_2$ system in the region with a high ZrO_2 content were investigated by x-ray diffraction. Measurements were made of the emf's of three cells in order to determine the Gibbs free energies of formation of $BaZrO_3$ from the oxides and the elements at 980–1120°K. Thermodynamic parameters of the formation of $BaZrO_3$ from the oxides and the elements at elevated and room temperatures were determined from the results. The agreement of the Gibbs free energies and the heats derived from the emf's of the experimental cells with one another and with the available calorimetric data is discussed. (2 tables) (auth)

14621 NATURE OF SOLID SOLUTIONS OF RADIOGENIC HELIUM IN LATTICES OF CERTAIN TRANSITION METALS. Berezhko, P. G. Russ. J. Phys. Chem. (Engl. Transl.); 48: No. 1, 12-14(Jan 1974).

Translated from Zh. Fiz. Khim.; 48: No. 1, 23-26(Jan 1974).

Literature data concerning the behaviour of radiogenic helium-3 in titanium and zirconium lattices are discussed. It is suggested that such "solid solutions" of helium are specific clathrate compounds of the noble gas with a variable composition. The hypothesis explains qualitatively the majority of the experimental observations. (auth)

14622 DEVELOPMENT OF WEAKLY ALLOYED MOLYBDENUM STEEL POWDERS FOR FORGED PARTS. Krantz, T. (Noranda Research Centre, Pointe Clair, Quebec). Mater. Tech.; 62: 117-124(1974). (In French).

14623 WELDABLE STEELS WITH HIGH LIMIT OF ELASTICITY WEAKLY ALLOYED WITH Mn–Mo–Nb. Boussel, P.; Imgrund, H.; Lauprecht, W. E. (Climax Molybdenum Co., New York). Mater. Tech.; 62: 87-100(1974). (In French).

14624 INFLUENCE OF AN INTERCRITICAL TREATMENT ON THE TEMPER EMBRITTLEMENT OF A ROTOR STEEL WITH Ni–Cr–Mo–V. Wada, T.; Doane, D. V. (Climax Molybdenum Co., Ann Arbor, MI). Mater. Tech.; 62: 105-115(1974). (In French).

14625 FERRITIC STEELS WITH HIGH CHROME CONTENT REINFORCING MOLYBDENUM. Colombie, M.; Condylis, A.; Desestret, A.; Mayoud, R.; Grand, R. (Creusot-Loire, Unieux, France). Mater. Tech.; 62: 157-170(1974). (In French).

14626 NEW STAINLESS FERRITIC STEEL WITH 18 PERCENT Cr AND 2 PERCENT Mo. Jarleborg, O.; Meyer, H. W.; Steigerwald, R. F. (Journee sur le Molybdene dans les Aciers Speciaux, Paris). Mater. Tech.; 62: 147-155(1974). (In French).

A steel with 18 percent Cr and 2 percent Mo is described which is perfectly insensitive to corrosion under tension and possesses an excellent resistance to corrosion by pitting and to spongy corrosion in chloride solutions. Compared with Cr–Ni austenitic steels, the 18 Cr–2 Mo steel is characterized by a higher limit of elasticity and a better aptitude for machining and cold working. Mechanical characteristics and physical properties are discussed, as well as welding properties. The steel is an excellent choice for the fabrication of tubes of heat exchangers and condensers. (IAA)

14627 SAMARIUM–COBALT ALLOY. Al'tman, A. B.; Gusev, V. Ya.; Gladyshev, P. A.; Kopylov, L. P.; Memelov, V. L.; Senin, V. A.; Shikhin, A. Ya. USSR Patent 384,922. 1 Oct 1973. Filed date 1 Jul 1971. (In Russian).

An alloy based on the system Sm–Co suggested, for example for manufacture of permanent magnets. In order to increase the oxidation resistance and stability as to chemical composition of permanent magnets, Fe is introduced to the alloy with the following component ratio (in %): Fe 8 to 10, Co 20 to 35, Sm–remainder. A permanent magnet made using this alloy has the following properties: B_r 3200 to 3700 gs, H_c 3200 to 3500 Oe, maximum magnetic energy 110,000 to 132,000 erg/cm^3. (Referativnyi Zh.)

14628 STRUKTURA I SVOYSTVA MONOKRISTALLOV TUGOPLAVKIKH METALLOV. (Structure and Properties of Single Crystals of Refractory Metals). Savitskii, E. M. (ed.). Moscow; Izdatel'stvo Nauka (1973). 258p.

Results are cited of investigations on the structure, electrical, emission, magnetic, and other physical properties of single crystals of refractory metals including the stability of structure and properties under different external effects (temperature, radiation, and plastic deformation). The collection is intended for metal physicists, chemical physicists, metal scientists, metallurgists, constructors, and machine and instrument builders. Included is information on molybdenum, molybdenum-base alloys, tungsten–rhenium alloys, tungsten, and niobium. (JPRS)

14629 MAGNETIC NEUTRON SCATTERING IN METALS AND ALLOYS. Gautier, F. (Univ., Strasbourg). Ann. Phys. (Paris); 8: No. 4, 251-318(Jul 1974).

From summer school on neutron scattering and magnetism; Autrans, France (26 Jun 1972).

The following topics are studied: general formulation for the neutron cross sections; Bragg scattering in ferromagnetic metals and alloys; diffuse scattering in dilute alloys and theoretical study of impurity states in transition metals; electronic structure of dilute ferromagnetic alloys; diffuse neutron scattering in concentrated alloys. (FR)

14630 ANOMALOUS ELECTRICAL RESISTIVITY OF THIN GADOLINIUM FILMS. Bist, B. M. S.; Srivastava, O. N. (Banaras Hindu Univ., India). Thin Solid Films; 24: No. 1, 137-142 (Nov 1974).

Electrical resistivity measurements at room temperature on thin Gd films 200 to 1000 Å thick are described. The resistivity–thickness curve exhibits a decrease in resistivity at lower thicknesses (less than about 500 Å), in marked contrast with other work. It is suggested that this curious resistivity characteristic in Gd films results from the thickness dependences of the structural phase and of the spin-disorder resistivity. (auth)

14631 RECRYSTALLIZATION OF InSb THIN FILMS OBTAINED BY CATHODE SPUTTERING. Jachimowski, M.; Kusior, E. (Dept. of Solid State Physics, Krakow). Thin Solid Films; 24: No. 1, 151-155(Nov 1974).

Thin polycrystalline n-type InSb films were prepared by cathode sputtering. The Hall mobility of the films was about 300 cm^2/V s. When the films were recrystallized by melting in an argon atmosphere at normal pressure, an influence of the sputtering conditions on the properties of the recrystallized films was found. Room temperature mobilities of 4000 cm^2/V s were achieved after recrystallization. (auth)

14632 EFFECT OF THE FILAMENT-MATRIX INTERFACE ON OFF-AXIS TENSILE STRENGTH. Klein, M. J. (International Harvester Co., San Diego, CA). pp 169-210 of Interfaces in Metal Matrix Composites. New York; Academic Press, Inc. (1974).

Consideration of three classes of theories predicting off-axis tensile strength in metal matrix composites, with continuous unidirectional filaments aligned at an angle to the direction of loading. In particular, the theory for strong interfaces, phenomenological theories, and the theory for weak interfaces are summarized. Studies of off-axis failure in niobium–tungsten, titanium–boron, titanium–borsic, aluminum–boron, aluminum–borsic, and in some other composite systems are reviewed. In addition to interface failure, some other competitive failure modes are shown to limit strength. Most of these studies are for the transverse orientation where the interface can have a large effect on composite strength and are restricted to relating the fracture mode to strength. Comparison of experiment and theory is shown to be only qualitatively meaningful, because theory is not yet sufficiently developed. (IAA)

14633 DIFFUSION IN A METAL WITH FORMATION OF TWO DEFINITE COMPOUNDS. Orszagh, J.; Vander Poorten, H. (Faculte Polytechnique, Mons, Belgium). Rev. Int. Hautes Temp. Refract.; 11: No. 2, 109-112(Apr 1974). (In French).

A correlation was established between the kinetic constants of formation of several superficial layers on a metal and the diffusion coefficients in the different phases. The foregoing calculation is applied to the diffusion of silicon in molybdenum at 1100°C. Kinetic constants of silicide coating formation found in the literature are used to calculate the diffusion coefficient of Si in $MoSi_2$, Mo_5Si_3, and Mo at 1100°C. Comparative experimental values of kinetic constants are given; these constants are derived from electrolytic siliconizing of Mo cathodes in fused silicates at 1100°C. Results are discussed. (FR)

14634 AUTORADIOGRAPHIC INVESTIGATION OF EUTECTIC ALLOYS Ni_3Al-Ni_3Nb. Bokshtein, S. Z.; Gubareva, M. A.; Kishkin, S. T.; Moroz, L. M. Dokl. Akad. Nauk SSSR; 215: No. 4, 829-832(1 Apr 1974). (In Russian).

Autoradiographic studies of the microstructure of the eutectic alloys of Ni_3Al-Ni_3Nb with normal and with oriented crystallization were made using ^{63}Ni as the tracer. Studies of the character of the diffusion showed that the structure of the alloy is inhomogeneous with respect to diffusion. The division surface between the two ductile phases in the alloy with oriented crystallization was semicoherent. Preferential diffusion along the phase boundaries occurs in the alloy with normal crystallization. An analysis of the diffusion flow showed that there are different regions in the eutectic alloy in which the structure of the alloy contains defects. These can be metastable sites inducing coarsening of the structure and the loss of the structural stability of the alloy. (JSR)

14635 PRECIPITATION IN TERNARY Ni-V-Nb ALLOYS. Moreen, H. A.; Taggart, R.; Polonis, D. H. (Rockwell International, Thousand Oaks, CA). Metallography; 7: No. 6, 513-521(Dec 1974).

A transition from a continuous ordering reaction to nucleation and growth was identified by means of transmission electron microscopy in aged Ni-V-Nb alloys. Substitution of 2.5 at. % Nb for V is sufficient to suppress the continuous ordering reaction observed in binary Ni-V alloys. This effect is attributed to the additional strain energy associated with the presence of Nb atoms in the fcc matrix. The equilibrium precipitate near the $Ni_3(V, Nb)$ composition is a DO_{22} structure for compositions below 5 at. % Nb and an orthorhombic Ni_3Nb type structure for alloys containing in excess of 5 at. % Nb. (auth) (5 figures)

14636 EFFECT OF PRESSURE ON THE CURIE TEMPERATURE OF $GdAl_2$ AND $TbAl_2$. Jaakkola, S. (Turku Univ. (Finland). Wihuri Physical Lab.). Phys. Lett., A; 50: No. 1, 35-36(4 Nov 1974).

The Curie temperatures of $GdAl_2$ and $TbAl_2$ were observed to increase with hydrostatic pressure up to 3.6 kbar at the rates of 0.71 ± 0.04 K/kbar and 0.60 ± 0.04 K/kbar, respectively. (auth)

14637 OBSERVATION OF A SMALL QUADRUPOLE INTERACTION IN ^{125}IFe MOESSBAUER SPECTRA. Langouche, G.; van Rossum, M.; Boolchand, P.; Meykens, A.; Coussement, R. (Louvain Univ. (Belgium)). Phys. Lett., A; 50: No. 1, 20-22 (4 Nov 1974).

In performing a systematic Moessbauer effect study of ^{125m}Te sources implanted in Fe, a small but decisive asymmetry between the intensities of the two prominent lines in the spectra was noticed. Although the nuclei are embedded in a cubic lattice, the asymmetry suggested arises due to the existence of a nonvanishing quadrupole interaction (QI). It is also pointed out that the magnitude and sign of this QI is unusually correlated to the ratio of nuclear g-factors $R = g_e/g_g$ for the case of ^{125}I. (auth)

14638 SPECIFIC HEAT AND INDUCED MOMENT IN $HoCo_2$ AND $TbCo_2$. Voiron, J. (Centre National de la Recherche Scientifique, 38—Grenoble (France). Lab. de Magnetisme); Berton, A.; Chaussy, J. (Centre National de la Recherche Scientifique, 38—Grenoble (France). Centre de Recherches sur les Tres Basses Temperatures). Phys. Lett., A; 50: No. 1, 17-19(4 Nov 1974).

The specific heats of $HoCo_2$ and $TbCo_2$ were measured between 4 and 300 K. The evaluated magnetic entropy of $HoCo_2$ and $TbCo_2$ is quite close to that calculated for the rare-earth alone, in agreement with a model where the cobalt moment is induced by the rare-earth. (auth)

14639 TEMPERATURE DEPENDENCE OF THE INCOMMENSURATE STRUCTURE OF THE $ErNi_{0.6}Cu_{0.4}$ COMPOUND. Gignoux, D.; Gomez-Sal, J. C. (Centre National de la Recherche Scientifique, 38—Grenoble (France). Lab. de Magnetisme). Phys. Lett., A; 50: No. 1, 63-64(4 Nov 1974).

The $ErNi_{0.6}Cu_{0.4}$ compound exhibits, below T_N(7K), an incommensurate magnetic structure. The transverse wave magnetic structure at 4.2 K becomes an antiphase structure at 1.3 K. The transition is due to the fact that Er^{3+} is a Kramer's ion. (auth)

14640 SOME TERNARY ALLOYS OF THE RARE EARTH HAVING THE Fe_2P-TYPE STRUCTURE. Ferro, R.; Marazza, R.; Rambaldi, G. (Univ., Genoa). Z. Anorg. Allg. Chem.; 410: No. 2, 219-224(Nov 1974).

The LnInRh and LnInPt compounds of various rare earths were prepared and studied by metallographic, x-ray examination, and density determination. Their structure is hexagonal Fe_2P-type. The characteristics of these compounds are compared with those of all the other isostructural compounds of the rare earths previously studied. (6 fig) (auth)

14641 EFFECT OF CHROMIUM, OXYGEN, AND MICROSTRUCTURE ON THE HARDNESS OF ZIRCONIUM-CHROMIUM ALLOYS. Rumball, W. M. (Royal Naval Engineering Coll., Plymouth, Eng.). J. Less-Common Metals; 39: No. 1, 35-42 (Jan 1975).

Empirical relationships were determined between the hardness and the chemical composition of Zr-Cr alloys. Hardness due to Cr in supersaturated solution (β-quenched alloys) is 150 × (wt. % Cr) VPN points, that due to Cr in the form of dispersed $ZrCr_2$, 13 × (wt % Cr) VPN points, and that due to oxygen in solution 0.05 × (ppm O) VPN points. The effect of oxygen decreases above concentrations of 2500 ppM but oxygen and Cr do not appear to interact in their effects on hardness. β-quenching contributes approximately 30 hardness points due to substructure, whilst the impurities in the base metal contribute about 10 hardness points. (8 fig, 3 tables) (auth)

14642 NUCLEAR MAGNETIC RESONANCE STUDY OF HYDROGEN DIFFUSION IN PALLADIUM AND PALLADIUM-CERIUM ALLOYS. Cornell, D. A.; Seymour, E. F. W. (Univ. of Warwick, Coventry, Eng.). J. Less-Common Metals; 39: No. 1, 43-54(Jan 1975).

Proton spin-lattice relaxation measurements were carried out on β-PdH_χ and $(Pd-Ce)H_\chi$ at 100 to 300°K and resonance frequencies of 7, 11, and 47 MHz. Contributions to the relaxation rate due to conduction electrons and due to hydrogen diffusion are identified. Measurements on β-$PdH_{0.7}$, undertaken both as a reference for the work on the alloys and also in an attempt to resolve an apparent discrepancy between earlier NMR and neutron scattering (Beg and Ross 1970) determinations of hydrogen diffusion rates, yield an activation energy for diffusion of 0.228 ± 0.010 eV for temperatures above 195°K; below 195°K interpretation of the data is uncertain. The relation with neutron scattering data is discussed. The difference between diffusion coefficients for the pure metal, and alloys containing 3% and 6% cerium, is less than 30% and it is concluded that the considerably higher hydrogen permeation rates in the alloys (Wise et al., 1972) are due to differences in surface processes. (5 fig, 2 tables) (auth)

14643 MAGNETIC PROPERTIES OF Sm-Pd ALLOYS. Jordan, R. G. (Univ. of Birmingham, Eng.); Loebich, O. Jr. J. Less-Common Metals; 39: No. 1, 55-62(Jan 1975).

Magnetic susceptibilities of Sm-Pd alloys over the entire compositional range were measured between 100 and 300°K in magnetic fields up to 10 kOe. Preliminary x-ray studies confirm the existence of the compounds Sm_7Pd_3 and Sm_3Pd_4, enabling a corrected Sm-Pd phase diagram to be presented. The susceptibilities of the compounds Sm_7Pd_3, Sm_3Pd_2, SmPd, Sm_3Pd_4, $SmPd_2$, $SmPd_3$, and $SmPd_5$ were interpolated and results indicate that the values for the compounds containing 40% and more Pd are suppressed below those expected by a simple dilution of the parent rare-earth metal. The compound Sm_7Pd_3 exhibits complex behavior. Below 183°K, the susceptibility is field-dependent and the magnetisation anisotropic, with the c axis of the hexagonal structure the preferred direction. Measurements in the Pd solid-solution range indicate that the effective valence of Sm is 3 when dissolved in Pd. (6 fig) (auth)

14644 MAGNETIC STUDIES OF OMEGA-PHASE PRECIPITATION AND AGING IN TITANIUM-VANADIUM ALLOYS. Collings, E. W. (Battelle Columbus Lab., OH). J. Less-Common Metals; 39: No. 1, 63-90(Jan 1975).

Room-temperature magnetic-susceptibility measurements were made on a series of quenched Ti-V alloys from 3 to 90 at. % V. The susceptibility (χ) responds strongly to the composition-related microstructure. In particular, there is a sharp discontinuity in the χ-composition curve at the boundary of the martensitic (α') and bcc-plus-omega-phase ($\beta + \omega$) regimes. The susceptibility of α'-Ti-V increases with composition up to a vanadium concentration of about 10 at. %, whilst that of "threshold" or "athermal" ω-Ti-V (14 at. %) is relatively low in value (roughly equal to that of pure hcp Ti). The susceptibilities of two representative $\beta + \omega$ alloys, Ti-V (15 at. %) and Ti-V (19 at. %), were measured at suitable intervals of time during aging for more than 1000 h at 300°C. In both cases, the susceptibility decreased as the ω phase developed towards its limiting composition. Using some results from published aging studies as calibration points, it was possible: (a) to derive a susceptibility value for ω-Ti-V (14 at. %); (b) to estimate the room-temperature susceptibilities of some single-phase β Ti-V alloys in the composition range in which they are unstable; (c) to follow, quantitatively, the progress of the $\beta + \omega$ decomposition of Ti-V (15 and 19 at. %) during aging. (9 tables, 12 fig) (auth)

14645 BARIUM-CADMIUM PHASE DIAGRAM. Dirstine, R. T. (Univ. of Cincinnati). J. Less-Common Metals; 39: No. 1, 181-183(Jan 1975).

The phase diagram was determined by differential thermal analysis and metallography of 30 alloys over the entire composition range. The compounds $BaCd_{11}$, $BaCd_8$, $BaCd_2$, BaCd, and possibly Ba_2Cd were found. (DLC)

14646 MAGNETIC PROPERTIES OF SOME Fe_2P-TYPE RARE-EARTH INTERMETALLIC COMPOUNDS. Buschow, K. H. J. (Philips Research Labs., Eindhoven, Netherlands). J. Less-Common Metals; 39: No. 1, 185-188(Jan 1975).

The variation of the a and c lattice constants with x was determined for the compounds $Gd_xTh_{1-x}PdIn$ and $Gd_xTh_{1-x}CuAl$. The c constant decreases strongly with x, while the a constant increases at first, then decreases. Similar results were obtained for $Y_xTh_{1-x}CuAl$ and $Y_xTh_{1-x}PdIn$, and their magnetic susceptibilities were also measured (they drop with decreasing x at x = 0.3 and 0.6, respectively). Results indicate that the RKKY model is valid and that the 5d electrons do not exert a large influence. Replacement Cu and Pd in GdCuAl and GdPdIn with Ni, a 3d element, does not appreciably shift the Curie temperature. (4 fig) (DLC)

14647 DELAY IN FATIGUE CRACK GROWTH. Wei, R. P.; Shih, T. T. (Lehigh Univ., Bethlehem, PA). Int. J. Fracture; 10: 77-85(Mar 1974).

Effects of a broad range of loading variables on delay in fatigue crack growth at room temperature are examined for a mill-annealed Ti-6Al-4V alloy. Results are used to estimate crack growth behavior under programmed loads. (auth)

14648 THERMODYNAMIC FUNCTIONS OF Zr(I) AND Zr(II) OVER THE TEMPERATURE RANGE 3000 TO 15000°K. Zyrnicki, W. (Polytechnical Univ., Wroclaw). Rocz. Chem.; 48: No. 7/8, 1159-1172(1974).

Values of electronic partition function, thermodynamic potential, enthalpy, entropy, and heat capacity of zirconium Zr(I) and Zr(II) over the temperature range 3,000 to 15,000°K were determined, by means of statistical calculations. (7 tables) (auth)

14649 EFFECT OF RARE EARTH ELEMENTS ON THE INTERNAL FRICTION OF IRON. Yu, M.; Yang, C. H.; Ch'en, T. Y. (Ningsia Univ., China). Wu Li Hsueh Pao; 23: No. 4, 292-298(Jul 1974). (In Chinese).

Internal friction measurements were made on commercial Fe specimens containing various amounts of Ce and La (combined content: 0, 0.011, 0.026, 0.037, 0.075, 0.124%). For specimens thoroughly treated with wet hydrogen to remove carbon and nitrogen impurities, the activation energy associated with the grain-boundary internal friction peak was found to vary with the content of Ce and La. A maximum appears around the content of 0.03%. The maximum activation energy is 11.3×10^4 cal/mole and is about twice the value for Fe free from Ce and La (6.4×10^4 cal/mole). For specimens loaded with C, the grain-boundary internal-friction peak was found to appear at a temperature 30°C higher than that of the specimen free from Ce and La. The activation energy associated with the grain-boundary peak was found to be 7.6×10^4 cal/mole (within ±2000 cal/mole) and is approximately independent of the Ce and La content. Measurements on the Snoek peak associated with C in Fe showed that the height of the peak decreases with the Ce and La content, whereas its position remains unaltered. The cold-work internal-friction peak of the original Fe specimen containing C and N appears around 230°C (cold-worked 88%), and this peak was considerably lowered with Ce and La content. After the specimens were fully treated with wet hydrogen and then loaded with nitrogen, the cold-work peak (cold-worked 88%) appears around 190°C. This peak was also considerably lowered with Ce and La content. Possible origins of the effect of the addition of rare earth elements on the three internal friction peaks (grain-boundary peak, Snoek peak, cold-work peak) of Fe are discussed. (JPRS)

14650 DEFORMATION MECHANISMS OF A UNIDIRECTIONALLY SOLIDIFIED Ni–W EUTECTIC ALLOY. Lasalmonie, A. (ONERA, Chatillon, France); Martin, J. W. Acta Met.; 22: No. 12, 1449-1456(Dec 1974).

The eutectic Ni–47.5 wt. % W was unidirectionally solidified to form a regularly aligned composite containing a volume fraction of 0.06 of W fibers with dia approx 1 μm in an α-Ni_4W (β) matrix. Material of matrix composition (Ni–38 wt. % W) was also produced, and the structure and orientation of the β-precipitates studied by transmission electron microscopy. Tensile tests were carried out on the composite material, and the deformation microstructures studied. Superlattice stacking-faults and microtwins are observed in the β-phase. The W fibers are found to lower the yield stress of the alloy, but greatly to increase the matrix ductility, by multiplying the number of slip systems in the α-β phases. (15 figures) (auth)

14651 THERMOTRANSPORT OF OXYGEN AND NITROGEN IN NIOBIUM AND TANTALUM. Kirchheim, A.; Fromm, E. (Max-Planck-Institut fuer Metallforschung, Stuttgart). Acta Met.; 22: No. 12, 1543-1551(Dec 1974).

Previous studies of thermotransport in the Nb–O, Nb–N, and Ta–O systems were extended to a wider concentration range of oxygen and nitrogen. It turns out that the strong concentration dependence of the heat of transport Q^+ found by Lohnert and Fromm in the Ta–O system appeared in the Nb–O system, too, and could be described by the following empirical formula $Q^+ = -(2,4/c)$ kcal at. %/mol. As the concentration c goes to zero, Q^+ reaches a constant value of about –16 kcal/mol. The same behavior was measured in the Ta–O system with a limit of –19 kcal/mol for $c \to 0$. In the Nb–N system, no thermotransport was found. Correlations between thermotransport and electrotransport which are discussed from a phenomenological point of view, indicate that electron drag forces play a dominant role in the mechanisms of interstitial thermotransport. This is confirmed in the present study by an argument, which is based upon the two-band model of H. B. Huntington and upon the similar concentration dependence of the absolute thermoelectric power and the heat of transport in the Ta–O system. (10 figures, 48 references) (auth)

14652 THE THERMALLY INDUCED REARRANGEMENT OF FIELD EVAPORATED RHENIUM AND RUTHENIUM SURFACES. Cranstoun, G. K. L.; Pyke, D. R. (Oxford Univ. (UK). Inorganic Chemistry Lab.). Surface Sci.; 46: No. 1, 101-117(Nov 1974).

The thermally induced rearrangement of field evaporated rhenium surfaces was investigated in the field ion microscope (FIM) in the temperature range 400–2000 K. The atomic processes involved in surface self diffusion were identified and approximate activation energies determined to provide information on the surface structures exposed by field evaporation. The initial diffusion observed at 475 K on $\{10\bar{1}0\}$ (dim plane), $\{10\bar{1}1\}$ (bright plane), $\{21\bar{3}3\}$, $\{31\bar{4}4\}$, and $\{20\bar{2}1\}$ is attributed to the displacement of surface atoms with five nearest neighbors, which leads to the formation on $\{21\bar{3}3\}$ of a well ordered superstructure of different symmetry to that on the field evaporated surface. In contrast, initial rearrangement is observed on ruthenium at $\{10\bar{1}0\}$ (dim plane), $\{10\bar{1}1\}$ (bright plane), $\{21\bar{3}3\}$, $\{31\bar{4}4\}$, and $\{31\bar{4}0\}$, indicating the presence of five-coordinate surface atoms on the field evaporated surface, in agreement with the results previously reported from low coverage oxygen adsorption experiments. At elevated temperatures, large flat facets are produced at the major close packed poles and, in the case of rhenium, approximate values of relative surface free energy have been obtained from the equilibrium end form. (auth)

14653 STUDY OF OXYGEN ADSORPTION ON A RHENIUM RIBBON BY MEASURING VARIATIONS OF THE WORK FUNCTION. Fusy, J.; Bigeard, B.; Cassuto, A. (Centre National de la Recherche Scientifique, 54–Villers-les-Nancy (France). Centre de Cinetique Physique et Chimique). Surface Sci.; 46: No. 1, 177-187(Nov 1974). (In French).

Adsorption and work function changes were followed on a recrystallized rhenium ribbon, preferentially oriented with the (0001) plane parallel to the surface, in an ultrahigh vacuum apparatus. Gas pressure was monitored by mass spectrometry and work function variations measured with the diode method in the retarding potential range, using an electron gun. Despite changes in saturation coverages, work function differences at saturation, and sticking coefficient with the adsorption temperature of the sample, curves giving the surface potential with coverage are characterized by a common part till a critical coverage (5×10^{14} atoms/cm^2), in the 300–850 K range. Comparison with LEED, thermal desorption and electron induced desorption results of the literature is in agreement with an adsorption induced surface rearrangement, above this critical coverage. (auth)

14654 CO-ADSORPTION OF OXYGEN AND CARBON MONOXIDE ON RHENIUM SURFACES. Alnot, M.; Ehrhardt, J. J.; Fusy, J.; Cassuto, A. (Centre National de la Recherche Scientifique, 54–Villers-les-Nancy (France). Centre de Cinetique Physique et Chimique). Surface Sci.; 46: No. 1, 81-100(Nov 1974). (In French).

Temperature programmed desorption (2.65 K/sec) was used to study carbon monoxide and mixed layers of carbon monoxide and oxygen on rhenium ribbons, strongly oriented parallel to the (0001) plane. Four binding states, populated in decreasing energy were detected. Interpretation of the results on β states agrees qualitatively with King's model postulating dissociation of carbon monoxide molecules and a repulsive interaction energy between carbon and oxygen atoms. However, in the co-adsorbed layers studies, it is shown that all the oxygen atoms do not play a part in the recombination process, during desorption, and that when

oxygen is adsorbed after carbon monoxide, a displacement reaction occurs, due to apparent transfer from β states towards molecular α states. Optimization of the results on pure carbon monoxide layers leads to an interactional energy ω, equal to 3 kcal/mole, and is only possible if it is assumed that β states are formed on alternatively filled and empty rows. (auth)

14655 EFFECT OF GAS PRESSURE IN THE ELECTRON BEAM PLANT CHAMBER ON THE PROPERTIES OF NIOBIUM ALLOY WELDED JOINTS. Kryukovskij, V. N.; Evgrafov, N. N.; Arakelov, A. G.; Tolstunov, A. V. Avtomat. Svarka; No. 2, 17-18(Feb 1973). (In Russian).

For English translation see the journal Autom. Weld.

The results of a study of the effect of the degree of vacuum in the vacuum chamber of an electron beam installation on the properties of weld compounds of Nb alloys were reported. An increase of the pressure in the vacuum chamber during electron beam welding of Nb alloys substantially affects the properties of the compound. In the VN2AE alloy a significant decrease of the impact strength was observed and in the ELN-1 alloy there was a sharp decrease in the ductility. (INIS)

14656 ALLOYING INFLUENCE ON THE TWIN INTERLAYERS STRAIN HARDENING IN Bi AND Be CRYSTALS AT STRESS FLUCTUATIONS. Bashmakov, V. I.; Bosin, M. E.; Lavrent'ev, F. F.; Papirov, I. I. Probl. Proch. Mashinostr.; No. 1, 80-84(Jan 1974). (In Russian).

For English translation see the journal Strength Mater.

In Be and Bi alloyed with Cu and Sn respectively, the development of single twins during pulsating stress was studied. A metallographic analysis of the neighboring twin boundaries in Be and Bi crystals of and Be–Cu and Bi–Sn alloys was made. An electron microscopic analysis was made of twinned Be crystals. (tr-auth)

14657 PHASE STRUCTURE OF THE Ti–V ALLOY SYSTEM. Molokanov, V. V.; Budberg, P. B. (AN SSSR, Moscow. Inst. Metallurgii). Dokl. Akad. Nauk SSSR; 215: No. 5, 1125-1127 (1974). (In Russian).

Studies to determine experimentally the possibility of the occurrence of a monotectoid conversion in the Ti–V system were made. The studies were made on six alloys with 30, 40, 50, 60, 66.7, and 80 at.% V, using microstructural, x-ray, and micro x-ray spectral analyses and by measurements of the microhardness and specific electric resistance. The phase composition of alloys of the Ti–V system at temperatures below 600° was made more precise. The location of the phase boundaries $\alpha + \beta/\beta$ reflects the general character of the conversions in systems with positive interaction parameters and metastable boundaries of immiscibility, lying in the two-phase region. The studies did not show the stratification of the solid solution and of the monotectoid conversion connected with it. (INIS)

14658 INFLUENCE OF COLD-WORK AND HEAT TREATMENT ON THE SUPERCONDUCTING PROPERTIES OF THE Nb–Ti ALLOY. Chao, Y. L.; Chang, G. H.; Yang, T. Y.; Wang, W. K. (Inst. of Physics, Peking). Wu Li Hsueh Pao; 23: 77-80(Jan 1974). (In Chinese).

14659 STRUCTURE, PHASE COMPOSITION, AND HEAT RESISTANCE OF ALLOYS OF THE SYSTEM Si–Ti–Mo. Vasil'eva, E. V.; Terent'eva, V. S. (Inst. of Metallurgy, Moscow). Inorg. Mater. (USSR) (Engl. Transl.); 10: No. 6, 879-881(Jun 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 6, 1023-1026(Jun 1974).

An investigation was made of the phase composition of Si–Ti–Mo alloys with a molybdenum content of 5 to 20 wt% and a titanium content of 15 to 40 wt %. All the alloys are polyphase systems with a eutectic. The complex silicide $(Ti,Mo)Si_2$ with a hexagonal structure exists in a wide region of homogeneity in the range $(Mo_{0.6-0.65}Ti_{0.4-0.35})Si_2$. At a constant molybdenum content (from 5 to 20 wt %), an increase in the titanium content up to 40 wt % raises the resistance of the alloys to high-temperature gas corrosion (1300°C, 100 h). The oxidation rate of all the alloys obeys a logarithmic law; at 1300°C after 100 h the rate is 0.02–0.04 mg/cm^2·h. (auth)

14660 STRESS RELAXATION AND DEVIATION FROM THE MECHANICAL EQUATION OF STATE IN COLD DRAWN TUNGSTEN WIRES. Magy, A. T. (Research Inst. for Technical Physics, Budapest). Scr. Met.; 9: No. 1, 27-30(Jan 1975).

Measurements of stress relaxation were carried out on 0.6-mm dia cold-drawn W wires doped with K, Al, and Si. Results show that strain hardening occurred, and that it cannot be related to the strain. The mechanical equation of state is not obeyed; a possible model is proposed in which the deviations can be related to the cell structure. (DLC)

14661 IN SITU OBSERVATIONS OF THE NUCLEATION AND GROWTH OF ORDERING IN Mg_3Cd. Butler, E. P.; Swann, P. R. (Imperial Coll. of Science and Tech., London). Scr. Met.; 9: No. 1, 9-14(Jan 1975).

Preliminary HVEM hot-stage observations are reported of the ordering reaction in Mg_3Cd. Results, using superlattice reflections, are consistent with a first-order nucleation and growth phase transformation. Heterogeneous nucleation also occurred. Kinetics of domain growth was followed. (DLC)

14662 ASPECTS OF THE CONSTITUTION OF ZIRCONIUM–HYDROGEN ALLOYS. Gill, B. J. (National Gas Turbine Establishment, Pyestock, Eng.); Cotterill, P.; Bailey, J. E. J. Less-Common Metals; 39: No. 1, 189-193(Jan 1975).

A study was made of the changes in microstructure and constitution produced by cooling Zr–H alloys (100, 250, and 600 ppMH) at different rates from the α-phase field. Metallography showed increased precipitation with H content and a change from grain-boundary precipitation to Widmanstätten structures with increasing cooling rate from the hydridation temperature (500°C). γ and δ hydrides were both present in all samples; the γ/δ ratio increases with cooling rate. Delta hydride was also found at very low H content (100 ppM) even under conditions of slow cooling. The needle-shaped hydride and the embrittling phase are not necessarily γ-hydride. (DLC)

14663 EDDY CURRENT ANOMALY FACTOR IN GADOLINIUM. Oosthuizen, C. P. (Rand Afrikaans Univ., Johannesburg); Alberts, L. J. Less-Common Metals; 39: No. 1, 173-177(Jan 1975).

Eddy current losses are a function of ferromagnetic domain size in rare earth metals. Such losses were measured in Gd sheet rings. The frequency dependence of the anomaly factor (ratio between classical and measured loss resistance) follows Carr's theory. The temperature dependence was also determined up to the Curie point (283°K); the mean spacing between the walls was also calculated and plotted vs temperature. Results show discrepancy with the theoretical values, indicating that eddy current measurements can only give a qualitative picture of the effective domain widths. (DLC)

14664 ROLLING DEFORMATION AND RECRYSTALLIZATION OF (111) [112] SINGLE CRYSTALS OF HIGH-PURITY TUNGSTEN, MOLYBDENUM, AND TANTALUM. Fujii, T.; Ohba, Y.; Tamura, Y. (National Research Inst. for Metals, Tokyo). J. Less-Common Metals; 39: No. 1, 161-172(Jan 1975).

All specimens with this orientation were shown to be stable on rolling; the sharpness of the rolled textures of Ta was lost to some extent on increasing the rolling temperature, although only slightly in the case of Mo. The recrystallization was observed to take place with greater difficulty in the edge regions of the transverse side of the specimens, where abnormal deformation would be expected to occur during rolling, than it did in the central region. The recrystallized textures of Mo rolled up to 60% reduction consisted of almost only one component, that of (110) [001], whilst for Ta there were two components, (110) [001] and (115) [552]. The recrystallized textures obtained by artificial recrystallization were not in accord with those carried out by spontaneous recrystallization. (5 fig, 3 tables, 43 references) (auth)

14665 FINE STRUCTURE OF $M_{IV,V}$ AND $N_{IV,V}$ ABSORPTION SPECTRA OF RARE-EARTH ELEMENTS. Demekhin, V. F. (Rostov State Univ., USSR). Sov. Phys.-Solid State (Engl. Transl.); 16: No. 4, 659-663(Oct 1974).

Translated from Fiz. Tverd. Tela; 16: No. 4, 1020-1027(Apr 1974).

A theoretical interpretation is presented of the measured fine structure of the $M_{IV,V}$ and $N_{IV,V}$ absorption spectra of rare-earth elements. Calculations were carried out for nine rare-earth elements: La, Ce, Eu, Gd, Tb, Dy, Ho, Er, and Tm. The proposed model was tested by calculating the energy levels of excited configurations and transition probabilities $3d^{10}4f^n \rightarrow 3d^94f^{n+1}$ and $4d^{10}4f^n \rightarrow 4d^94f^{n+1}$. The Slater integrals and parameters of the spin–orbit interaction were calculated from the Herman–Skillman functions; for the $N_{IV,V}$ absorption spectra, the magnitude of the 4d–4f Coulomb interaction was reduced by a factor of 1.5. The calculation was carried out in the LS coupling model with an allowance for the n4–4f, 4f–4f Coulomb interactions, and for the spin–orbit interaction of the nd electrons (n = 3 for the $M_{IV,V}$ absorption spectra and n = 4 for the $N_{IV,V}$ absorption spectra). Analysis of the obtained results indicates that the fine structure is due mainly to the interaction of the electrons occupying the unfilled 4f shell with the 3d and 4f shells. (auth)

14666 THERMODYNAMIC PROPERTIES AND DEFECT STRUCTURE OF $V_{0.99}Ti_{0.01}O_{1.5+x}$ SOLID SOLUTIONS AT HIGH

TEMPERATURES. Balabaeva, R. F.; Vasil'eva, I. A.; Gerasimov, Ya. I. (Moscow State Univ.). Dokl. Chem.; 216: No. 4-6, 434-437(Jun 1974).

Translated from Dokl. Akad. Nauk SSSR; 216: No. 6, 1285-1288 (Jun 1974).

The relationships $\overline{\Delta G_{O_2}}$ (x), $\overline{\Delta H_{O_2}}$ (x), and $\overline{\Delta S_{O_2}}$ (x) were determined for the solid solution $V_{0.99}Ti_{0.01}O_{1.5+x}$ over the temperature range 1223 to 1323°K and at x = 0.008 to 0.017. The system was studied by the emf method with a solid electrolyte. The values found for the thermodynamic relations were tabulated and an analysis of these data indicate that ΔH_{O_2} and ΔS_{O_2} are almost completely independent of x in the limits and that therefore one type of defect predominates. The analytical data were analyzed on the assumption that the defect is interstitial oxygen and good agreement was found between calculated and experimental values of ΔG_{O_2} and ΔS_{O_2}. From the experimental data it is concluded that the addition of 1% Ti_2O_3 to V_2O_3 decreases the equilibrium oxygen pressure over the solid solution studied as compared to that over $VO_{1.5+x}$. The addition of Ti_2O_3 increases the energy of bonds in the $VO_{1.5+x}$ lattice. Substitution of the lighter Ti atoms for V in the $V_{1.5+x}$ lattice increases θ_i and ν_i in accordance with Rayleigh's theorem. (JSR)

14667 NIOBIUM IN LOW-CARBON STEELS. Popova, L. V. (Central Scientific-Research Inst. of Ferrous Metallurgy, Moscow). Metal Sci. Heat Treat. (USSR) (Engl. Transl.); 16: No. 5-6, 514-517(1974).

Translated from Metalloved. Term. Obrab. Metal.; 16: No. 6, 54-57(Jun 1974).

The principles of adding Nb to steels to improve their properties are discussed. It is shown that by varying the rolling and heat treatment conditions, one can obtain different properties in steel of the same composition. (6 fig) (DLC)

14668 STRUCTURAL CHARACTERISTICS AND MECHANICAL PROPERTIES OF CARBON STEEL WITH NIOBIUM AND VANADIUM. Shepelyakovskii, K. Z.; Marshalkin, A. N.; Kanygin, V. A. (Moscow Evening Metallurgical Inst.). Metal Sci. Heat Treat. (USSR) (Engl. Transl.); 16: No. 5-6, 528-530(1974).

Translated from Metalloved. Term. Obrab. Metal.; 16: No. 6, 68-70(Jun 1974).

Addition of 0.6% V and 0.6% Nb to steel with 0.6% C (steel 60BF) resulted, after preliminary normalization at 850°, in an austenite grain size of 2.7 μ (grade 14) that was stable during heating to 850-1050° at rates of 20-60°/sec. Isothermal holding for as long as 180 sec at 950° does not lead to grain growth. The austenite grain size of steel 60BF after quenching from 850-1050° is 2.5-2.0 μ. The austenite grain size remains essentially unchanged for the steel subjected to preliminary quenching or normalization. Effect of tempering temperature on the mechanical properties of steel 60BF and 60 in relation to the austenite grain size was investigated. The steels with smaller grains have better properties at all tempering temperatures except of 500-650°. Due to aging processes at these temperatures, the ultimate and yield strengths and the modulus of elasticity are higher for steel 60BF with coarse grains than for the steel with fine grains. (auth)

14669 CARBIDES OF THE MC TYPE IN TUNGSTEN-MOLYBDENUM HIGH-SPEED STEELS. Baikov, A. M.; Baranova, L. I.; Kupalova, I. K. Metal Sci. Heat Treat. (USSR) (Engl. Transl.); 16: No. 5-6, 533-535(1974).

Translated from Metalloved. Term. Obrab. Metal.; 16: No. 6, 72-74(Jun 1974).

A method for separating MC carbides from the carbide mixture was developed which makes it possible to determine the chemical composition and some properties of the MC carbide. The W-Mo steels R12, R6M3, M6, R9, and R6M5 were analyzed using this method, which consists of treating the separated carbide residues with 1:1 H_2SO_4:H_3PO_4. Results show that MC carbide is a highly alloyed carbide with a VC lattice in which 22 to 35% of the V atoms are replaced with W, Mo, and Cr atoms. (DLC)

14670 STAGES OF AGING IN ALLOYS V93pch AND V93pch + Zr. Khol'nova, V. I.; Cherkasov, N. N.; Elagina, Z. A.; Proshchitskii, B. E. Metal Sci. Heat Treat. (USSR) (Engl. Transl.); 16: No. 5-6, 384-385(1974).

Translated from Metalloved. Term. Obrab. Metal.; 16: No. 5, 18-20(May 1974).

With equal strength and corrosion resistance, alloy V93pch (7 Zn-2 Mg-1 Cu) has better elongation, impact strength, and work of fracture in tests of precracked samples than alloy V93pch + 0.17 Zr. The plastic characteristics of alloy V93pch can be improved by aging at 120° for 3 h + 175° for 6 h. (auth)

14671 EXPERIMENTAL DATA ON THE THERMAL PROPERTIES OF HIGH-MELTING METALS. Fillippov, L. P.; Trukhanova, L. N.; Makarenko, I. N.; Arutyunov, A. V. pp 51-56 of Teplofizicheskie svoistva tverdykh veshchestv. Samsonov, G. V. (ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian).

Thermal conductivity, specific heat, emissivity, and electrical resistance of a commercial brand (PL-1) of platinum are studied experimentally and plotted against temperature (1000 to 2200°K). The thermal conductivity, temperature conductivity, specific heat, and electrical conductivity of pure Ta, W, Nb, Re, V, Ti, Zr, Hf, Rh, Mo, and Ir are plotted for temperatures up to 3000°K. (IAA)

Radiation Effects

Refer also to abstracts 15295 and 15624.

14672 (AD-784403) COOPERATIVE RADIATION EFFECTS SIMULATION PROGRAM. Semiannual Progress Report, 1 November 1973-30 April 1974. Steele, L. E.; Wolicki, E. A. (Naval Research Lab., Washington, D. C. (USA)). Jul 1974. 133p. (NRL-MR-2866). NTIS $4.75.

Progress is reported in: devising an approach to the calculation of the energy partition of an atomic collision cascade in multi-element materials, extending existing calculations and writing a computer code for calculating heavy-ion lateral ranges, developing a new transport theory for heavy ion beams near a target surface, an investigation of the dose dependence of nickel-ion damage in nickel, studies of the flux (dose rate) dependence of void growth in 2.8-MeV nickel-ion-irradiated nickel, studies of helium temperature during helium implantation, development of a helium depth profiling system, and the design of experiments and equipment for studying irradiation-induced creep of structural alloys by cyclotron bombardment. (GRA)

14673 (AI-AEC-13140) FERRITE FORMATION IN NEUTRON-IRRADIATED TYPE 316 STAINLESS STEEL. Garr, K. R.; Stanley, J. T. (Atomics International Div., Canoga Park, Calif. (USA)). 31 Oct 1974. Contract AT(04-3)-824. 22p. Dep. NTIS $4.00.

Magnetic measurements were made on Type 316 stainless steel specimens that had been neutron irradiated to fluences of 1.8×10^{22} n/cm^2 at 425°C and 3.5×10^{22} n/cm^2 (E > 0.1 MeV) at 500 and 600°C. A significant increase of magnetization was observed for the irradiated specimens. The shape of the magnetization versus field curves showed that the irradiated specimens contained many small superparamagnetic particles. The magnetic particles are assumed to be the ferrite phase although other possibilities cannot be excluded. The amount and distribution of the magnetic phase varied with pre-irradiation and post-irradiation heat treatment. The maximum value of magnetization was equivalent to 3.6% ferrite in a specimen annealed 100 h at 760°C before irradiation and 1 h at 500°C after irradiation at 425°C. (4 tables, 5 fig) (auth)

14674 (JUL-1088-FF) CHANGES IN THE ELASTIC PROPERTIES OF Al AFTER LOW-TEMPERATURE ELECTRON IRRADIATION. Robrock, K. H. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Festkoerperforschung). Jul 1974. 95p. (In German). Dep. NTIS (US Sales Only) $7.75.

Thesis. Submitted to Technische Hochschule, Aachen (F.R. Germany).

Changes in the elastic properties after 6°K electron irradiation of Al single crystals were measured using a low-frequency torsion pendulum. Both internal friction and torsion modulus were measured accurately as a function of irradiation dose and temperature. Effects observed can be divided into two different categories: (1) An external stress or tension induces elastic dipole moments of the defects and leads to a dielastic modulus change. Measurements show that it is negative, very large, and anisotropic. A relative decrease of the modulus C_{44} of 27% and of the modulus $C' = C_{11}-C_{12}/2$ of 15% is obtained per % defect. (2) Defects can already have naturally a permanent elastic dipole moment. In this case, in an external stress or tension, they are de-oriented into energetically more favorable positions. This process leads to a maximum in the internal friction and to a characteristic modulus decrease. (25 fig., 43 references) (JSR)

14675 (NRL-7820) MICROSTRUCTURE AND SWELLING OF FAST NEUTRON IRRADIATED TYPE 304 STAINLESS STEEL. Michel, D. J.; Smith, H. H.; Atwell, J. T. (Naval Research Lab., Washington, D. C. (USA)). 9 Dec 1974. 21p.

Effects of high-fluence, fast-neutron irradiation on the microstructure, swelling, and microhardness were evaluated for annealed Type 304 stainless steel that had attained fluences near 1.6×10^{23} n/cm^2 > 0.1 MeV at irradiation temperatures from 370 to 470°C. Transmission electron microscopy was employed to characterize the radiation-induced void and defect structures. A maximum swelling of 10.4% was determined by immersion density measurements and independently confirmed from the

microscopy data. Ambient temperature microhardness measurements were found to be in general agreement with calculated microhardness values based on the microscopy data. The calculations indicate that the radiation-induced voids were the primary microstructural component responsible for the measured microhardness. All results show the strong influence of the irradiation temperature and neutron-fluence gradients experienced by the material during the EBR-II exposure. (auth)

14676 (NRL-Report-7813) STRENGTH AND NOTCH DUCTILITY OF SELECTED STRUCTURAL ALLOYS AFTER HIGH-FLUENCE, 550 F (288 C) IRRADIATION. Hawthorne, J. R.; Watson, H. E. (Naval Research Lab., Washington, D. C. (USA)). 2 Dec 1974. 25p.

Tensile strength and Charpy-V (C_v) notch ductility changes were explored for several low alloy structural steels. The study was addressed to metal fracture resistance at upper shelf temperatures and encompassed A302-B, A533-B, A543-1, 9Ni-4Co-.20C, 12-6PH, and 12Ni-5Cr-3Mo steel compositions. Material forms included plate, forging, and weld deposit. Specimen irradiations were conducted in the Advanced Test Reactor; neutron fluences ranged from 1 to 7×10^{20} n/cm^2 > 1 MeV. Consistent trends in pre- and postirradiation yield strength vs temperature were observed for all materials. Some capability for uniform strain hardening was shown by each material, irrespective of fluence condition. A significant detrimental effect of high copper content (≥0.15% Cu) on yield strength behavior with neutron exposure was noted for A302-B/A533-B and A543 steels. The implications to postirradiation fracture resistance of C_v upper-shelf values were assessed using NRL-developed Ratio Analysis Diagram (RAD) procedures. RAD assessments of a low-Cu A533-B plate and weld deposit indicated that thick sections of either material would exhibit plastic fracture behavior after 2.5×10^{20} n/cm^2 > 1 MeV at 550°F(288°C). An experimental 12-6PH alloy of higher strength is also shown to have promise for high-fluence applications. A predicted trend for C_v upper-shelf energy vs yield strength change with increasing fluence was confirmed by the present findings. (7 fig, 3 tables) (auth)

14677 (WANL-TME-1274) STRUCTURAL MATERIALS EXPERIMENT 37/W402 IRRADIATED AT PLUM BROOK REACTOR FACILITY PBRF CYCLE 38P (PB No. 10W). Preliminary Data Report. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1965. 22p. Dep. NTIS $4.25.

Preliminary results are given of the irradiation of 78 Inconel 718 specimens that were statically tested in a rotating fixture in the HT-1 facility of PBR. Pre-insertion, irradiation, and post-withdrawal data are presented. (DLC)

14678 (WANL-TME-1297) STRUCTURAL MATERIALS IRRADIATION EXPERIMENT AT PLUM BROOK REACTOR FACILITY. Experiment 37/W402 (PBRF Cycle 38P, PB No. 10W). Zorn, J. B. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1965. 24p. Dep. NTIS $4.00.

This experiment was conducted on Aug. 20 to 25, 1965, to study radiation effects on Inconel 718 tensile specimens in simulated NERVA radiation and restart environments. Test conditions and post-irradiation testing are described; no data are given. (DLC)

14679 (WANL-TME-1821(Rev.2)) FINAL TEST SPECIFICATION: Cu-^{10}B MATERIALS TEST, 37/W409. Revision 2. Coombe, J. R.; Shogan, R. P. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Oct 1968. 25p. Dep. NTIS $4.25.

This specification is for the NERVA radiation effects testing program. Tensile properties are to be measured as functions of temperature, orientation, fast neutron fluence, and annealing temperature/time. Requirements and procedures are given. (DLC)

14680 (WANL-TME-2791) NEUTRON IRRADIATION EFFECTS ON THE TENSILE PROPERTIES OF INCONEL 718, WASPALOY AND A-286. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jun 1971. 61p. Dep. NTIS $6.25.

Sheet tensile specimens of three NERVA candidate structural alloys were irradiated at 585°R in the Plum Brook Reactor and subsequently tested at temperatures from 540 to 1940°R. Thermal and fast neutron fluences as high as 1.5×10^{20} and 2×10^{19} n/cm^2 respectively were obtained. A-286 and Waspaloy exhibited yield strength increases and ultimate strength and elongation decreases at temperatures below 1140°R and severe elongation decreases above 1340°R. The total elongation decreases were much more significant than those of the uniform elongation. Inconel 718 exhibited similar effects except for a slight unexplained decrease in yield strength at all temperatures after irradiation. None of the alloys appeared to be superior in resistance to high temperature irradiation embrittlement. (33 tables, 11 fig, 23 references) (auth)

14681 EXISTENCE OF TWO TYPES OF PINNING POINTS ON DISLOCATIONS IN IRRADIATED AND COLD-WORKED ALUMINUM. Esnouf, C.; Fantozzi, G.; Gobin, P. F. (Institut National des Sciences Appliquees, Villeurbanne, France). J. Phys. (Paris), Lett.; 35: No. 6, L.81-L.84(Jun 1974). (In French).

The simultaneous study of the Bordoni relaxation and the modulus change measured at 20°K after neutron irradiation at 77°K and cold-working at 10 or 80°K shows the existence of two types of pinning points: one on the geometric kinks, another on dislocation segments lying along Peierls's valleys. The second type of pinning point is less stable than the first. In addition, for high irradiation doses, a wide maximum appears, which seems linked to the Bordoni relaxation. (FR)

14682 ION IMPLANTATION AND HYPERFINE INTERACTIONS IN METALS. Bernas, H. (Paris Univ., Orsay, France). Rev. Phys. Appl.; 9: No. 3, 575-585(May 1974).

A very simplified description of angular distribution hyperfine interaction techniques is given, with a view to presenting their application in ion-implantation studies of metals. Some typical experiments are reviewed. Radiation damage effects in hyperfine interaction studies after ion implantation are discussed. (FR)

14683 EFFECT OF NEUTRON BOMBARDMENT ON STRUCTURAL CHANGES IN DEFORMED ALUMINUM SINGLE CRYSTALS DURING ANNEALING. Larikov, L. N.; Plotnikova, N. P. (Inst. of Metal Physics, Kiev). Ukr. Fiz. Zh. (Ukr. Ed.); 19: 737-742(May 1974). (In Ukrainian).

Neutron irradiation with a dose of 5×10^{19} n/cm^2 at 70°C of the deformed Al single crystals does not affect essentially the final recrystallization structure but results in some dispersion of the recrystallization texture. (5 fig, 2 tables) (auth)

14684 EFFECTS OF RADIATION ON THE VIOLET SOLAR CELL. Arndt, R. A. (COMSAT Physics Lab., Clarksburg, MD). COMSAT Tech. Rev.; 4: 41-52(Apr 1974).

The violet solar cell, which generates nearly 5 mW per sq cm more power than solar cells employed in present commercial communications satellites, hereafter referred to as satellite cells, has been irradiated with 1-MeV electrons to a fluence of 10^{16} per sq cm and with 2- and 4-MeV protons to a fluence of 10^{13} per sq cm. An electron fluence of about 10^{15} per sq cm or a proton fluence of 2×10^{10} per sq cm is required to reduce the power output of the violet cell to that of the satellite cell at beginning of life. The violet cell produces more power after low neutron fluences than a fully recovered Li-doped cell and only a few percent less power after high neutron fluences. (auth)

14685 RADIATION STABILITY OF A-1 TYPE FUEL PINS. Novak, J. Nukleon; No. 4, 27-30(Dec 1973). (In Czech).

Two radiation experiments conducted with fuel pins of the A-1 type are described. The experiments aimed at obtaining information on the consequences of the radiation growth and the creep of metallic uranium. (INIS)

Other Materials

Refer also to abstracts 13508, 13704, 13737, 13738, 13749, 14543, 15294, 15568, and 15625.

14686 (BNL-19089) INFLUENCE OF THE AMORPHOUS PHASE ON BORON ATOM DISTRIBUTIONS IN ION IMPLANTED SILICON. Crowder, B. L.; Ziegler, J. F.; Cole, G. W. (Brookhaven National Lab., Upton, N. Y. (USA)). 1972. 10p. (CONF-721226-3). Dep. NTIS $4.00.

From 3rd international conference on ion implantation in semiconductors and other materials; New York, New York, USA (11 Dec 1972).

The nuclear reaction ^{10}B(n,^{4}He) ^{7}Li was used to investigate the B depth distribution obtained by ion implantation into crystalline Si in a "random" direction and into amorphous Si produced by Si ion bombardment. The presence of the amorphous phase before B ion implantation has a pronounced effect on the B depth distribution (i.e. implantation into misaligned crystalline Si is not equivalent to implantation into amorphous Si). The presence of an amorphous phase has a marked effect on the amount of diffusional broadening of the B distribution during annealing at 900°C. (5 fig) (auth)

14687 (WANL-TME-833) STUDY OF SOME MANUFACTURING PARAMETERS AS THEY RELATE TO THE "C" DIRECTION THERMAL CONDUCTIVITY OF INSULATING TILE. Blay, J. S. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 31p. Dep. NTIS $4.75.

Fourteen tests were conducted for evaluating the effect of bow and taper on the "c" direction thermal conductivity of insulating tile manufactured from pyrolytic graphite. It was established that no change resulted on tilting the basal planes at an angle of 0°45′. Increasing the angle to 1°15′ resulted in a 28% increase, and an angle of 2°30′ increased the conductivity by 44%. This data permits a relaxation of the present bow and taper limitations as follows: If the bow of the first deposited surface is less than 0.008", the taper may be up to 20% of the blank thickness. If the bow is 0.008"–0.015" the taper must be less than 10%. The taper of a "blank" having a bow of 0.015"–0.020" should not exceed 7.5%. Two thermal conductivity tests were conducted for studying the effects of spalled first deposited surfaces, which displaces the tile to the last deposited portion of a tile blank. It was established that on fine grain continuously nucleated material this displacement could result in a 30% increase in the "c" direction thermal properties. On this particular furnace run, HM-14, acceptance tests on which coupons were taken from the first deposited portion were well within the limits of the specification. The 30% increase, resulting from displacing the coupon to the last deposited portion, would have exceeded the specification. It is recommended that no change be made to the present spalling limitations of fine grain continuously nucleated material. A review of past supplier performance and their manufacturing methods disclosed that 7200 insulating tile, represented by 170 thermal conductivity tests, manufactured from the last deposited portion of six furnace runs of tile blank had met the thermal requirements of the specification. In the case of fine grained continuously nucleated tiles only 75% of the furnace runs met these requirements. Since the substrate nucleated structure appears to be more uniform within a blank, and controllable from furnace run to furnace run, it has been recommended that only substrate nucleated pyrolytic graphite be utilized for manufacturing insulating tile. The above combination of relaxed bow and taper limitations, the deletion of spalling limitation on substrate nucleated material, and simplicity of manufacturing utilizing either deposited surface for basal plane orientation should result in a substantial cost reduction. (auth)

14688 (WANL-TME-1314) EVALUATION OF A PROCESS FOR MANUFACTURING AS-DEPOSITED ID INSULATING CUPS. Blay, J. S. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Nov 1965. 22p. Dep. NTIS $4.25.

A satisfactory evaluation was completed of a new manufacturing process concept for producing insulating cups of improved physical integrity by vapor depositing the inside diameter to the requirements of the drawing with no machining of the ID required. The feasibility of the process was established by depositing pyrolytic graphite on six 0.6050 in. dia male mandrels. This size was calculated to yield a 0.615 in. ID. No delaminations intersected the ID. The OD surfaces appeared to be physically improved. Coating adherence and quality on the as-deposited surfaces were the equal of that obtained on machined surfaces. The mean of the ID was 0.617 in. This ID, toleranced ±.004 in., was acceptable to Mechanical Design. A pre-production furnace run consisting of 486 0.6050 in. dia mandrels was made for evaluating the process for meeting of ID of 0.617 ± .004 in. Product yield (33%) was as good as that experienced with machined cups. No ID spalling was observed, and there was a significant reduction in the spalling occurring on the OD and large radius. Inspection data generated from the furnace run indicated that increasing the mandrel diameter .0020 in. to 0.6070 in. should result in an improvement in the product yield of future runs of the as-deposited ID insulating cup. (auth)

14689 (WANL-TME-1632) EVALUATION OF SX-5 GRAPHITE. Kachur, V. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jun 1967. 44p. Dep. NTIS $5.25.

Results are presented of physical, thermal, and mechanical tests to determine the properties of high-expansion SX-5 graphite. All properties were evaluated on 3.5 × 17.8 × 60-inch extruded plate stock with a 33-mil maximum coke particle size. The density of SX-5 was predominantly 1.70 to 1.72 g/cm³, with extreme values of 1.69 and 1.76 g/cm³. The flexure/tension strength ratio was 1.377 ± 2%, regardless of the density or grain orientation. Stress-versus-strain data were obtained between room temperature and 2400°C in tension, and only at room temperature in compression. Relations of parameters is discussed. Following parameter values were determined at room temperature:

Density	Grain	Electrical Resistivity	Average Strength Values		
			Tension	Flexure	Compression
(g/cm³)	Orient.	(milliohm-cm)	(psi)	(psi)	(psi)
Above 1.725	WG	0.75 to 0.85	--	4755	9740
Below 1.725	WG	0.85 to 0.90	3080	4250	8430
Above 1.725	AG	0.90 to 1.05	--	3335	9770
Below 1.725	AG	1.05 to 1.15	1860	2656	8280

(auth)

14690 (WANL-TME-1961) TEST SPECIFICATION: GRAPHITE THERMAL CONDUCTIVITY IRRADIATION TEST (PHASE 1–ATJ AND POCO AXM 9Q) 37/W415. Coombe, J. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1969. 7p. Dep. NTIS $4.00.

Requirements and test matrix are given for measuring cryogenic and room-temperature irradiated effects on thermal and electrical conductivities of the two graphites. Fast neutrons will be used. (DLC)

14691 EVAPORATION OF POLYTETRAFLUOROETHYLENE BY ELECTRON BOMBARDMENT OF THE BULK MATERIAL. De Wilde, W. (Univ. of Ghent). Thin Solid Films; 24: No. 1, 101-111(Nov 1974).

The evaporation of polytetrafluoroethylene (PTFE) from a normal electron-gun evaporation source is described and the evaporation mechanism is discussed. It is believed that the PTFE decomposes on heating by electron bombardment and that the monomer so formed repolymerizes on the substrate as a result of bombardment by stray electrons. From infrared spectroscopy and analysis of the temperature coefficient of capacitance, it appears that the deposited polymer film is in an amorphous state and that many chain ends occur. Electrical measurements suggest that the dielectric is pinhole-free, contains no detectable amount of mobile ions, has a permittivity of about 2.4, a dielectric loss factor tan δ of about 0.004, and a dielectric strength of 2×10^6 V/cm. (auth)

14692 RADIATION HEATING OF DIELECTRICS BY REACTOR IRRADIATION. Tsetskhladze, T. V.; Nadirashvili, L. Sh.; Emel'yanov, K. A. pp 109-122 of Yaderno-khimicheskie yavleniya v tverdykh telakh. Tsetskhladze, T. V. (ed.). Tbilisi, USSR; Izdatel'stvo Metsniereva (1973). (In Russian).

Experimental data are given and the effect of radiation heating of amorphous silicon oxide and lithium fluoride on physical chemical phenomena related to radiation damage in the reactor is discussed. Results are of general character and give an idea on the extent of possible heating of small samples of dielectrics in research pool-type reactors. (10 figures) (auth)

14693 CRYSTAL STRUCTURE AND FLUORESCENCE LIFETIME OF $NdAl_3(BO_3)_4$, A PROMISING LASER MATERIAL. Hong, H. Y. P.; Dwight, K. (Massachusetts Inst. of Tech., Lexington). Mater. Res. Bull.; 9: No. 12, 1661-1665(Dec 1974).

The structure of $NdAl_3(BO_3)_4$, determined by single-crystal x-ray analysis, is rhombohedral with space group R32 and cell parameters a = 9.3416 (6)Å, c = 7.3066 (8)Å, Z = 3. A full-matrix, least-squares refinement gives R = 0.033 and Rw = 0.037. The Nd atoms, Al atoms, and B atoms occupy trigonal prisms, octahedra, and triangles of oxygen, respectively. Edge-shared Al octahedra form helices along the c-axis. These helices are connected by isolated B triangles and isolated Nd trigonal prisms. The fluorescence lifetime of the $^4F_{\frac{3}{2}} \rightarrow {}^4I_{\frac{11}{2}}$ transition of Nd^{+3} is reported for the system $Nd_xGd_{1-x}Al_3(BO_3)_4$. The lifetime of $NdAl_3(BO_3)_4$ is 19 μs, and concentration quenching is reduced in the series, as happens in $NdNa_5(WO_4)_4$ (85 μs) and NdP_5O_{14} (115 μs). The shorter lifetime is attributed to noncentrosymmetry, the reduced concentration quenching to isolation of Nd polyhedra. (auth)

14694 SUPERCONDUCTIVITY OF TWO NaCl STRUCTURE COMPOUNDS: α-ZrP AND ScS_{1+x}. Moodenbaugh, A. R.; Johnston, D. C.; Viswanathan, R. (Univ. of California, San Diego, La Jolla). Mater. Res. Bull.; 9: No. 12, 1671-1675(Dec 1974).

Both ZrP (high-temperature α form) and ScS_{1+x} ($0 \leq x < 0.5$) crystallize in the NaCl structure. Each was observed to be superconducting with transition temperatures up to 5°K. (auth)

14695 SUPERCONDUCTIVITY IN HYDRATED TERNARY TANTALUM SULFIDES. Sernetz, F. (Zentralinstitut fuer Tieftemperaturforschung, Garching, Ger.); Lerf, A.; Schoellhorn, R. Mater. Res. Bull.; 9: No. 12, 1597-1602(Dec 1974).

Hydrated ternary tantalum sulfides $A^{+}_{0.3}(H_2O)_y[TaS_2]^{0.3-}$, with A^+ being a group Ia or group IIa cation, were found to be superconducting. T_c are in the range of 2.7 to 5.4°K. Magnetization measurements were used to determine the bulk T_c and the thermodynamic critical field $H_c(T)$. In dependence of the ionic radius r of A, T_c exhibits a maximum at $r \approx 1.1$ Å in both the alkali and alkaline earth series. No correlation was found between T_c and the basal spacing d of the hydrated phases. It is concluded that the potential two-dimensional superconductivity in these compounds is essentially characterized by participation of the interlayer cation. (auth)

14696 ANOMALOUS BEHAVIOR OF THE INTENSITY OF BRAGG REFLECTIONS OF V_3Si. Kodess, B. N. (Ural Polytechnic Inst., Sverdlovsk). Sov. Phys.-Solid State (Engl. Transl.); 16: No. 4, 782-783(Oct 1974).

Translated from Fiz. Tverd. Tela; 16: No. 4, 1216-1218(Apr 1974).

The temperature dependence of the intensity of the Bragg x-ray reflections was studied for two V_3Si samples. One sample with a superconducting $T_c = 17.0$°K exhibited a structural transition near 30°K, while no phase transition was found for the sample with $T_c = 16.8$°K. From the Bragg reflections, the lattice instability is somewhat higher for a sample with a structural phase transition, and that this transition is accompanied by a preliminary increase of vibration amplitude of the atoms belonging to different sublattices of the A-15-type compound. The first sublattice to become distorted in such a transition is the bcc sublattice occupied by atoms of the nontransition component. (DLC)

14697 PROTECTIVE COATINGS (PAINTS) FOR THE NUCLEAR INDUSTRY. New York; American Institute of Chemical Engineers (1974). 18p. (ANSI-N-5.12-1974; ICONS-01924).

This standard is the result of a comprehensive examination of experience and data on protective coatings over the past 30 years. It provides a basis for evaluating and selecting protective coatings (paints) for nuclear facilities, and guidelines for surface preparation, application, and inspection of these coatings in the shop and field. (DLC)

14698 NON-ACTIVATED LUMINESCENCE APPEARING IN GLASS DURING ELECTRON BOMBARDMENT. Karapetyan, G. O.; Muminov, V. A.; Raimbaev, S. A. (Inst. of Nuclear Physics, Tashkent). Dokl. Akad. Nauk Uzb. SSR; No. 7, 26-27 (1974). (In Russian).

During the study of cathode luminescence of glass, data were obtained on nonactivated luminescence of silicate, borate, phosphate, and quartz glass during electron bombardment. Two luminescence bands, one lying between 460 and 520 nm and the other at ~980 nm, were observed. Activation of the glass with Eu^{3+} noticeably suppresses these bands. Kinetics of the rise and damping of the radiation bands were determined; they indicate the formation of metastable excitation levels or capture levels. (JSR)

14699 EFFECT OF CRYSTAL LATTICE DISORDER ON PEIERLS TRANSITIONS. Bulaevskii, L. N.; Sadovskii, M. V. (Inst. of Physics, Moscow). Sov. Phys.-Solid State (Engl. Transl.); 16: No. 4, 743-746(Oct 1974).

Translated from Fiz. Tverd. Tela; 16: No. 4, 1159-1164 (Apr 1974).

The effect of disorder on Peierls structural transitions is considered for quasi-one-dimensional crystals of the $K_2Pt(CN)_4Br_{0.3}\cdot 3H_2O$ type and for salts based on TCNQ. The exactly solvable Lloyd disorder model and the "fragment" model are considered. It is shown that in both models disorder causes a strong suppression of the Peierls transition, and its effect is qualitatively similar to the effect of magnetic impurities on the superconducting transition. Possible experimental consequences are discussed. (auth)

14700 EFFECTS OF PRESTRESSING BORON/EPOXY PREPREG ON COMPOSITE STRENGTH PROPERTIES. Mills, G. J.; Dauksys, R. J. AIAA (Amer. Inst. Aeronaut. Astronaut.) J.; 11: No. 11, 1459-1460(Nov 1973).

Information is presented on a method for improving strength and data scatter on Prepreg composite tapes. The graphs presented are not always self-explanatory but in conjunction with the text provide accurate information. (App. Mech. Rev.)

14701 RADIATION STUDIES OF MATERIALS USING COLOR CENTERS. Sibley, W. A. (Oklahoma State Univ., Stillwater); Pooley, D. pp 45-128 of Treatise on Materials Science and Technology. Vol. 5. Herman, H. (ed.). New York; Academic Press, Inc. (1974).

The aim of this chapter is to give an introduction to color center physics and to show how it can be used to study radiation damage. Radiation damage in insulators in particular is considered: alkali halides, alkaline earth halides, and alkaline earth oxides. Examples of technological applications of color centers are given. (49 figures, 207 references) (DLC)

14702 INFLUENCE OF A CRITICAL PARAMETER ON DEVELOPMENT OF AN ADVANCED ABLATIVE. Mukherjee, M. K.; Sarkar, B. K.; Govindaraju, K. (Indian Space Research Organization, Trivandrum). pp 337-346 of International Symposium on Space Technology and Science. Tokyo; AGNE Publishing, Inc. (1973).

From 10th international symposium on space technology and science; Tokyo, Japan (3 Sep 1973).

In order to study the properties of advanced ablatives, two types of conventional ablatives were selected: (1) an asbestos epoxy system and (2) an asbestos-phenolic system. Both were coated with W-Co alloy by an electrolytic method. The specimens with various coating time were tested with an oxy-acetylene torch burner, and the erosion rate was determined. The advanced ablatives thus developed by varying the W-Co coating time were found to have an effectively reduced erosion rate. The role played by the various variables, such as resin, reinforcements, fabrication method, environmental conditions, etc. are briefly discussed. Finally, the possibility of using these W-Co alloy coated materials for thermal protection of nozzle and other relevant rocket component like nose cone, etc. is discussed. (auth)

14703 TRANSFORMATIONS IN OXIDES AFFECTED BY ELECTRON BOMBARDMENT IN VACUUM. Mikhajlov, G. S. Elektron. Obrab. Mater.; No. 2, 43-46(1974). (In Russian).

For English translation see the journal Appl. Electr. Phenom.

The factors responsible for the resistance of metallic oxides to the dissociating effect of electron bombardment in a vacuum were examined. The possibility of the existence of at least two types of electron dissociation of the solid oxides (electron dissociation of oxide completely into metal and oxygen and dissociation with formation of very stable lower oxides) was discussed. New possibilities for the use of electron-beam processing of materials and analysis of substances by the electron probe method were shown. Hypotheses were made on the possible reasons for the increased concentration in some samples of lunar rocks of metals whose oxides are stable with respect to the effects of electron bombardment. (tr-auth)

14704 CHANGES IN THE DIMENSIONS OF GRAPHITE CRYSTALLITES DURING IRRADIATION AND HEAT TREATMENT. Virgil'ev, Yu. S.; Volga, V. I.; Usov, V. K. Inorg. Mater. (USSR) (Engl. Transl.); 10: No. 6, 858-860(Jun 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 6, 997-1000(Jun 1974).

Thermal conductivity of polycrystalline graphite between 80 and 320°K was investigated in relation to irradiation by fast neutrons and subsequent thermal annealing. During thermal annealing, restoration of the crystallite dimensions, assessed by means of the Debye equation for the phonon thermal conductivity, is slower than restoration of the x-ray structural characteristics. This is due to the high activation energy of migration of vacancies and their complexes, and their resultant low mobility, in comparison with interstitial atoms. (auth)

NUCLEAR MATERIALS AND WASTE MANAGEMENT

Accountability and Safeguards

Refer also to abstract 13627.

14705 (AEC-tr-7603) CONTROL OF NUCLEAR MATERIALS AND INSPECTION OF PROCEDURES ENSURING THIS CONTROL. (CEA, 75-Paris (France)). 20 Sep 1974. Translation of Extract from Ministerial Instruction No. 71-312 MDIS/CAB/AD, IG-CMN 74-84, Annex I, II, pp 13. 11p. Dep. NTIS $4.00.

The CEA instruction deals with control and inspection procedures to ensure the control of nuclear materials. It is applicable for all public and private organizations in possession of Pu or 20%-enriched U in amounts in excess of 1 kg. (TFD)

14706 (CONF-740622-10) FAST-RESPONSE FUEL ROD CALORIMETER FOR 36 INCH FUEL COLUMNS. Beyer, N. S.; Lewis, R. N.; Perry, R. B. (Argonne National Lab., Ill. (USA)). Jun 1974. 14p. Dep. NTIS $4.00.

From meeting of Institute of Nuclear Materials Management; Atlanta, Georgia, USA (19 Jun 1974).

The primary interest in fuel rod calorimeters is due to the high measurement precision attainable with such instrumentation. However, for this interest to be sustained by those who need to make safeguards-type inventory control measurements, it must have a relatively fast measurement-response-time. This report describes the design features and the results of evaluation tests of a new, fast-response, fuel rod calorimeter than can be used to nondestructively measure a 36 inch fuel column (FFTF size) of mixed-oxide fuel. With this instrument, Pu measurements can be made in 13 to 23 minutes with an accuracy of ±0.12 to 0.13% relative. (auth)

14707 (DPSPU-74-11-20) EVALUATION OF A GAMMA/X-RAY SPECTROMETER SYSTEM FOR THE NONDESTRUCTIVE ANALYSIS OF PLUTONIUM AND URANIUM. Gibbs, A. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Plant). Nov 1974. Contract AT(07-2)-1. 14p. Dep. NTIS $4.00.

Findings by the Savannah River Plant in the evaluation of a computer-based spectrometer system for gamma-ray and x-ray fluorescence analyses are summarized. The system was developed by the Lawrence Livermore Laboratory for the Division of Safeguards and Security of the Atomic Energy Commission. Field testing is being performed at SRP with weapons-grade plutonium and related process samples. The instrumentation was designed to be transportable so that it could be used for accountability analyses at AEC and privately owned sites processing fissile material. Nondestructive assay of plutonium and uranium and analysis of plutonium for isotopic content are the principle measurements for which this equipment was designed. The system employs techniques which determine the amount of plutonium-238, -239, -240, and -241 by measurement of their associated gamma rays. Because plutonium-242 emits no usable gamma rays, this isotope must be measured by other methods. Plutonium concentration can be measured by gamma-ray analysis if the plutonium is highly purified and relatively free from interfering gamma rays. Otherwise, plutonium and uranium concentrations are measured by x-ray fluorescence analysis. (auth)

14708 (LA-5681) PORTAL MONITOR FOR DIVERSION SAFEGUARDS. Chambers, W. H.; Atwater, H. F.; Fehlau, P. E.; Hastings, R. D.; Henry, C. N.; Kunz, W. E.; Sampson, T. E.; Whittlesey, T. H.; Worth, G. M. (Los Alamos Scientific Lab., N. Mex. (USA)). Jul 1974. Contract W-7405-eng-36. 35p. Dep. NTIS $4.00.

Two prototype personnel portal monitors were designed, constructed, and tested. These monitors can be used at personnel exits from special nuclear material (SNM) access areas to deter the diversion of SNM. One prototype uses plastic scintillators, the other contains NaI(Tl) detectors. Both units have a digital sliding-interval warning logic system. Detection sensitivities of both units for bare minimum surface-area samples are about 4 g of 93% ^{235}U and 0.1 g of weapons-grade plutonium. (auth)

14709 (LA-5771-PR) NUCLEAR ANALYSIS RESEARCH AND DEVELOPMENT. Program Status Report, May-August 1974. Keepin, G. R. (Los Alamos Scientific Lab., N. Mex. (USA)). Nov 1974. Contract W-7405-eng-36. 14p. Dep. NTIS $4.00.

The status of the Nondestructive Assay R & D program of the LASL Nuclear Analysis Research Group is presented. The topics reported include: ^{252}Cf fuel rod assay system for green HTGR fuel rods; nondestructive assay of small samples for phase II of the HTGR interlaboratory comparison program; nondestructuve assay of miscellaneous HTGR material by subthreshold neutron interrogation; calculational support for the small-sample assay system; status of the NRDS active assay system; passive gamma-ray assay services; neutron detector for analysis of UF_6 in 2S cylinders; solid transuranic waste assay at the 10-nCi/g level; in-line installation of the SAFE effluent-water monitor at LASL; multienergy californium assay system (MECAS); modulated ^{252}Cf assay system "shuffler"; automated neutron assay equipment for Richland Operations Office; ^{252}Cf-based hydrogen monitor; and assay bias due to nonlinear calibration. (TFD)

14710 HOW IMPROBABLE IS THE HOME-MADE NUCLEAR BOMB. Dotto, L. (Globe and Mail, Toronto). Sci. Forum; 7: No. 5, 3-5(Oct 1974).

Tighter security and safeguards in the use, transportation, and storage of plutonium will be needed by the year 2000, when it is estimated that 750 tons of this material will be produced annually by some 5000 nuclear reactors around the world. (CA)

Disposal and Storage

Refer also to abstract 13802.

14711 (ANL-8134) CHEMICAL ENGINEERING DIVISION WASTE MANAGEMENT PROGRAMS QUARTERLY REPORT, April-June 1974. Steindler, M. J.; Levitz, N. M.; Mecham, W. J.; Seefeldt, W. B.; Trevorrow, L. E.; Gerding, T. J.; Kullen, B. J.; Webster, D. S.; Burris, L. (Argonne National Lab., Ill. (USA)). Nov 1974. Contract W-31-109-eng-38. 54p. Dep. NTIS $5.45.

Effort on several diverse areas of work related to the study of consolidation techniques for fuel-cladding hulls is reported, along with an outline of the program for FY-1975. The emphasis of work was shifted largely to reviewing information on processes that have applicability to the decontamination of hulls, and finding sources of and negotiating for a supply of irradiated Zircaloy for the upcoming experimental program. A brief review is presented of the program for FY-1974 on the salvage of alpha-contaminated metals. An assessment of pertinent information indicates that a pyrochemical concept appears to be the most suitable approach to solving the problem of decontamination and salvage of alpha-contaminated metals. Injection of low-level aqueous waste (LLAW) into deep-lying permeable geological strata may be advantageous for decreasing the environmental impact of tritium created in LWR power production. Literature dealing with deep-well injection of other types of liquid wastes was reviewed to determine what topics should be addressed in an evaluation of the feasibility of deep-well injection of LLAW. From this review, it was concluded that the topics of most importance in such an evaluation include (1) expected composition of LLAW and the required pre-injection treatment, (2) estimates of present costs, (3) clarification of legal and regulatory constraints, (4) development of additional detail on location of geologically suitable sites, and (5) analysis of environmental risks. A simplified analysis was made of the impact of alternative forms of high level waste and canister metals on the equivalence of protection following 100-yr storage. For this study, designs that resulted in a specified release of high level wastes by corrosion of the container followed by leaching (or erosion) of the waste were considered equivalent. Waste forms considered were calcine and glass. Stainless steel and mild steel were selected as container materials. It was determined that in a water coolant, 100-yr storage of calcine can be made equivalent to the 100-yr storage of glass by providing added thickness to canister walls. Air cooling could not be thoroughly evaluated because of the lack of air-erosion data of waste forms. (auth)

14712 (ARH-3032) SPECIFICATIONS AND STANDARDS FOR THE PACKAGING, STORAGE, AND DISPOSAL OF RICHLAND OPERATIONS SOLID WASTES. Anderson, J. D. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). 29 Apr 1974. Contract AT(45-1)-2130. 19p. Dep. NTIS $4.00.

The Atlantic Richfield Hanford Company (ARHCO) receives and stores or disposes of solid radioactive and nonradioactive solid wastes routinely generated at HAPO. Solid radioactive waste is also received from offsite Atomic Energy Commission (AEC) contractors and stored or disposed of by ARHCO in the

200 Areas at special request from the AEC. Nonradioactive, nonhazardous, combustible wastes are collected from contractors by ARHCO on an informal schedule and transported by specially-equipped compactor vehicles to the Central Landfill Facility. These wastes are monitored for unacceptable radiation levels, then covered with earth daily to minimize the opportunity for combustion and/or wind-scattering of the wastes. The purpose of this document is to provide specifications and standards which will assure that all solid wastes handled by ARHCO are packaged and stored or disposed of in accordance with: (1) ARHCO Waste Management Program Objectives; (2) ARH-220, July 1, 1972, "Radiation Protection Standards and Controls;" (3) AEC Manual Chapter 0510, March 7, 1968, "Waste Disposal," its Richland Operations Office (RL) Supplement and Appendix; and (4) AEC Manual Chapter 0511, September 19, 1973, "Radioactive Waste Management." (TFD)

14713 (BNWL-SA-5128) HIGH-LEVEL RADIOACTIVE WASTE MANAGEMENT. Schneider, K. J.; Liikala, R. C. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. Contract AT(45-1)-1830. 41p. (CONF-741070-1). Dep. NTIS $5.25.

From frontiers of power technology conference; Stillwater, Oklahoma, USA (9 Oct 1974).

High-level radioactive waste in the U. S. will be converted to an encapsulated solid and shipped to a Federal repository for retrievable storage for extended periods. Meanwhile, the AEC is actively pursuing the development of concepts for ultimate disposal of the waste which the Federal Government would manage. A number of promising concepts have been proposed, for which there is high confidence that one or more will be suitable for long-term, ultimate disposal. Initial evaluations of technical (or theoretical) feasibility for the various waste disposal concepts show that in the broad category (i.e., geologic, seabed, ice sheet, extraterrestrial, and transmutation) all meet the criteria for judging feasibility, though a few alternatives within these categories do not. Preliminary cost estimates show that, although many millions of dollars may be required, the cost for even the most exotic concepts is small relative to the total cost of electric power generation. For example, the cost estimates for terrestrial disposal concepts are less than 1% of the total generating costs. The cost for actinide transmutation is estimated at around 1% of generation costs, while actinide element disposal in space is less than 5% of generating costs. Thus neither technical feasibility nor cost seems to be a no-go factor in selecting a waste management system. The seabed, ice sheet, and space disposal concepts face international policy constraints. The information being developed currently in safety, environmental concern, and public response will be important factors in determining which concepts appear most promising for further development. (auth)

14714 HARWELL HAZARDOUS WASTES SERVICE. England, V. L. (UKAEA, Harwell, Eng.). Process Technol. Int.; 18: No. 8-9, 331(1973).

The Hazardous Wastes Service at AERE Harwell was formed to meet the needs of public bodies and industry to the disposal, treatment, and assessment of dangerous materials. Harwell is qualified to perform this service because it has 25 yr of experience in handling toxic, flammable, corrosive, and other dangerous materials in the field of atomic energy. Methods developed for the safe handling and proper disposal of radioactive materials have been extended to include many other kinds of hazardous materials that arise in industry and scientific research. Examples of current and recent work at Harwell and the services offered by this institution are discussed. (Pollut. Abstr.)

Transportation

14715 (ARH-3063) HEAT TRANSMISSION TEST OF AN L-3 CLASS II SHIPPING CONTAINER. Herbolsheimer, J. A. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). 30 Apr 1974. Contract AT(45-1)-2130. 15p. Dep. NTIS $4.00.

To comply with the requirements of the Atomic Energy Commission Manual Chapter 0529, a Safety Analysis Report for Packaging (SARP) must include a study of the effects of a hot and a cold environment upon the package in question. The L-3 Class II shipping container is intended for the transportation of large quantities of fissile radioactive materials. These materials are contained in a nominal three-liter polyethylene bottle enclosed in a polyvinyl chloride bag. The bottle and bag are sealed inside a $4^{13}/_{16}$ inch inside diameter, stainless steel pressure vessel having a flanged, bolted closure. The pressure vessel is centered and supported by a welded tubular structure within an overpack of a 55-gallon removable-head drum. Vermiculite insulation material fills the space between the vessel and the drum. The fully-loaded weight is approximately 265 pounds. The test had three objectives: (1) to determine the temperature difference between the radioactive solution and the skin of the L-3, due to decay heat; (2) to find the overall heat transfer coefficient for the shipping container; and (3) to gain an appreciation of the thermal lag of the L-3, in terms of the temperature response of the contents of the packaging to a change in ambient temperature. (RCK)

14716 (LA-5808-MS) INVESTIGATION OF DOT SPECIFICATION 2R CONTAINERS TO MEET SPECIAL FORM CERTIFICATION. Andrae, R. W. (Los Alamos Scientific Lab., N. Mex. (USA)). Nov 1974. Contract W-7405-eng-36. 9p. Dep. NTIS $4.00.

A test program was conducted to investigate the qualifications of 2R, pipe nipple-cap type containers as a special form encapsulation. The testing included a 30-ft (9.14-m) drop, impact with a 3-lb (1.36-kg) weight, heating to 1475°F (1075°K) and immersion in water, as specified in the DOT Spec., Par. 173.398. Results indicate that the use of the 2R, pipe nipple-cap container as a special form encapsulation should probably be restricted to the shipment of solids and then only under the conditions that soluble solids are adequately protected by an inner container. (auth)

PARTICLE ACCELERATORS

Design, Development, and Operation

Refer also to abstracts 15078, 15438, and 15476.

14717 (BNL-19407) SEARCH FOR THE "ABNORMAL NUCLEAR STATE." Uranium Ion Acceleration in the AGS. Prelec, K.; van Steenbergen, A. (Brookhaven National Lab., Upton, N. Y. (USA)). Aug 1974. 40p. Dep. NTIS $5.00.

Recent theoretical work speculates on the existence of "abnormal nuclear states" which could possibly be created as a result of collisions of superenergetic heavy nuclei. For this reason the possibility of ^{238}U acceleration in the AGS has been studied. Acceleration of $\gtrsim 10^9$ ^{238}U particles per second to ≤ 12 GeV/nucleon kinetic energy, i.e. $\simeq 3$ TeV total energy, is feasible without modification of the AGS vacuum system and basic rf system by using a (surplus) fast cycling synchrotron as a booster ring. This booster is required in order to obtain the fully stripped ion state, since partially stripped uranium ion acceleration in the AGS is impractical because of extreme vacuum pressure requirements. The fast cycling feature of the booster is essential in reducing transmission losses associated with uranium ion electron capture or loss during acceleration and beneficial in increasing the time average uranium ion beam intensity. (auth)

14718 (CEA-CONF-2722) INTENSE BEAMS OF 100 TO 500 MeV POSITRONS. Aune, B.; Juillard, M.; Netter, F.; Pacchioni, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Physique Nucleaire). [nd]. 3p. (CONF-740522-41). Dep. NTIS (US Sales Only) $4.00.

From 9th international conference on high energy accelerators; Stanford, California, USA (2 May 1974).

The present status of the acceleration of positrons at the high intensity Saclay's electron linac is described. Availability of average currents of 1 μA for 100 MeV positrons and higher than 0.5 μA for 450 MeV positrons is demonstrated. Major improvements are including the use for the first acceleration of the positrons of a new section with a 1.5 m long triperiodic standing wave structure, fed with the full RF power of one arm of a TV2013 klystron (2 MW peak-30 kW average power). (auth)

14719 (LBL-3431) COMPUTER UTILIZATION FOR DESIGN AND OPERATION OF THE SUPERHILAC. Selph, F. B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Oct 1974. Contract W-7405-eng-48. 9p. (CONF-741001-38). Dep. NTIS $4.00.

From CUBE symposium; Livermore, California, USA (23 Oct 1974).

The in-house constructed computer codes at the SuperHILAC can be divided into three main categories, i.e., accelerator and component design; control and operation; and performance and diagnostics. The first category includes design programs of rf cavities, magnets, and beam optics. The second group contains programs for administration and logbook entries, machine parameter specifications, and openloop parameter control. Programs in the third category are those which directly or indirectly test the mechanical design and geometry of the machine, such as magnet testing, drift-tube-alignment, beam behavior and diagnostics. The present conversion of the Super HILAC to computer control and a dual-ion time-sharing mode of operation is outlined in context with the complexities of operating this multi-ion, variable energy accelerator. Routines are discussed from the user's standpoint, covering such topics as on-line/off-line implementation, expected gain, actual results, and differences in characteristics which determine the method of computation. (auth)

14720 JINR TANDEM CYCLOTRON. Shelaev, I. A.; Alfeev, V. S.; Zager, B. A.; Kozlov, S. I.; Mel'nikov, V. N.; Oganesyan, R. Ts. (Joint Inst. for Nuclear Research, Dubna, USSR). pp 186-192; 269 of Trudy Tret'ego Vsesoyuznogo Soveshchaniya po Uskoritelyam Zaryazhennykh Chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd All-Union conference on the charged particle accelerators; Moscow, USSR (1973).

This study describes an experiment which uses a combination of two, heavy-ion cyclotrons to obtain beams of xenon ions having energies up to 7 MeV/nucleon with the 310 cm-cyclotron being used as an injector and the two-meter cyclotron being used as the main accelerator. Characteristics of the vacuum systems of both accelerators are presented. Features of beam transport and ion injection into the two-meter cyclotron are described. An analysis is carried out to make compatible the ion bundles entering from the first accelerator with time intervals such that these ions can be captured during acceleration in the second accelerator. The experience of operating the tandem-cyclotron showed that the total efficiency of the accelerator was 2%. (tr-SJR)

14721 REPORT ON THE FIRST STAGE OF THE ITEP PROTON SYNCHROTRON RECONSTRUCTION. Barabash, L. Z.; Gol'din, L. L.; Koshkarev, D. G.; Onosovskii, K. K.; Barkhudaryan, A. V.; Veselov, M. A.; Gibenko, Yu. G.; Zavodov, V. P.; Zenkevich, P. R.; Kleopov, I. F.; Lapitskii, Yu. Ya.; Lebedev, P. I.; Nachatyi, N. I.; Sokolov, L. I. (Inst. of Theoretical and Experimental Physics, Moscow). pp 193-199 of Trudy Tret'ego Vsesoyuznogo Soveshchaniya po Uskoritelyam Zaryazhennykh Chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd All-Union conference on charged particle accelerators; Moscow, USSR (1973).

This study presents information on the planned and completed modifications in the magnetic system of a proton synchrotron, in the feed system of the magnetic units, the high-frequency system, the vacuum system, the magnetic field correction system, the beam observation system and the injection system. These modifications, which form the first stage of synchrotron reconstruction were brought about by the necessity of effecting a slow withdrawal of the primary proton beam into an experimental chamber and of improving the parameters of secondary beams which are generated on internal targets of the accelerator. (tr-SJR)

14722 BEAM WITH A HIGH PULSE RESOLUTION. Bayukov, Yu. D.; Gavrilov, A. B.; Kats, M. M.; Leksin, G. A.; Maksimov, N. G.; Miller, V. V.; Smirnitskii, A. V.; Sokolov, L. I.; Talyzin, A. N. (Inst. of Theoretical and Experimental Physics, Moscow). pp 202-208 of Trudy Tret'ego Vsesoyuznogo Soveshchaniya po Uskoritelyam Zaryazhennykh Chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd All-Union conference on charged particle accelerators; Moscow, USSR (1973).

This study deals with the investigation of the possibility of creating an intensive, precision beam in the ITEP accelerator by means of standard equipment. It is proposed that the momentum of each particle be more accurately defined by fixing its point of origin at the first focus and by not limiting the range of momenta propagated by the system. A plan for arranging the beam equipment, the optical scheme of the beam, and the main characteristics of the beam are presented. (tr-SJR)

14723 ELECTRON-POSITRON BEAMS IN THE ITEP PROTON SYNCHROTRON. P'yankov, A. P.; Sokolov, L. I. (Inst. of Theoretical and Experimental Physics, Moscow). pp 212-215 of Trudy Tret'ego Vsesoyuznogo Soveshchaniya po Uskoritelyam Zaryazhennykh Chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd All-Union conference on the charged particle accelerators; Moscow, USSR (1973).

This study considers the practical aspects of obtaining a beam of electrons or positrons in the ITEP proton synchrotron. A description is given of a scheme to extract an electron-positron beam for a xenon bubble chamber and to arrange the equipment in order to obtain an electron-positron beam with the use of the already available pion beam loop. The results of experiments carried out on the beams that were obtained are presented. (tr-SJR).

14724 SLAC RECIRCULATING LINEAR ACCELERATOR (RLA). Helm, R. H.; Herrmannsfeldt, W. B.; Hogg, H. A.; Lisin, A. V.; Loew, G. A.; Murray, J. J.; Neal, R. B.; Wilson, P. B. (Stanford Linear Accelerator Center, CA). pp 216-226 of Trudy Tret'ego Vsesoyuznogo Soveshchaniya po Uskoritelyam Zaryazhennykh Chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973).

From 3rd All-Union conference on charged particle accelerators; Moscow, USSR (1973).

The paper describes the principle of recirculating the beam to increase its energy from 20 to 45 GeV in the recirculating linear accelerator (RLA). The beam dynamics is analyzed and a number of incoherent and coherent instabilities are taken into account in the RLA operation. The specific features of the rf system, magnets, and the vacuum system are described and the schematic layout of the RLA is shown. (INIS)

14725 DESIGN FEATURES OF THE RESONANCE SYSTEM AND THE VACUUM CHAMBER OF THE HIGH CURRENT SYNCHROCYCLOTRON. Vaulina, I. G.; Konstantinov, Yu. A.; Malyshev, I. F.; Naumov, V. I.; Peregud, V. I.; Popkovich, A. V.;

Spirchenko, Yu. V.; Chvartatskii, R. V.; Shenderovskii, S. P. (Scientific-Research Inst. of Electrophysical Equipment, Leningrad). pp 262-265 of Trudy Tret'ego Vsesoyuznogo Soveshchaniya po Uskoritelyam Zaryazhennykh Chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd All-Union conference on the charged particle accelerators; Moscow, USSR (1973).

This report presents a general view of the OIYal synchrocyclotron and describes features of the resonance system and vacuum chamber of the cyclotron, in which it is proposed that a beam current up to 50 microamps be obtained by increasing the accelerating voltage to 50 kV and the cycle frequency to 600 cps. The resonance system is a half-wave, plane homogeneous line 6 m wide and 7.15 m long. Tuning of the characteristic frequency of the system in the required range is accomplished by two capacitance frequency transformers with rotating rotors whose axes are parallel to the edge of the dee. The vacuum volume is formed from the accelerating chamber, the body of the frequency transformers and the intermediate chamber inside of which the dee is installed. (tr-SJR)

14726 ACCELERATOR DEVELOPMENT IN THE NEAREST FUTURE. Komar, A. A. (Inst. of Physics, Moscow). pp 271-274 of Trudy Tret'ego Vsesoyuznogo Soveshchaniya po Uskoritelyam Zaryazhennykh Chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd All-Union conference on charged particle accelerators; Moscow, USSR (1973).

This paper considers the prospects of developing accelerators in connection with further studies of elementary particles and their interactions. The greatest interest lies in studies on the presence of a connection between electromagnetic and weak interactions. For a comprehensive study of various types of interactions there will be requirements for both cyclic proton accelerators having energies in the range of 5000 to 20000 GeV (to obtain secondary beams) and also installations having colliding beams at an energy of about 200 GeV. (tr-SJR)

14727 NEW ACCELERATOR AT CERN. Crowley-Milling, M. S. (CERN, Geneva). pp 282-291; 311 of Trudy Tret'ego Vsesoyuznogo Soveshchaniya po Uskoritelyam Zaryazhennykh Chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973).

From 3rd All-Union conference on charged particle accelerators; Moscow, USSR (1973).

Progress report on the CERN 300-GeV proton synchrotron is presented. The specific features of the magnet system are discussed. They have adopted the "missing magnet" scheme in which the bending magnets are dipoles and the focusing is carried out by separate quadrupoles. In the magnet system the use of superconducting magnets may be envisaged if they are available in a few years. The injection system and the rf system are discussed. (INIS)

14728 BEVATRON HEAVY-ION PROGRAM. Grunder, H. A.; Hartsough, W. D.; Lofgren, E. J.; Tobias, C. A. pp 303-309 of Trudy Tret'ego Vsesoyuznogo Soveshchaniya po Uskoritelyam Zaryazhennykh Chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973).

From 3rd All-Union conference on charged particle accelerators; Moscow, USSR (1973).

In August, 1971, the first high-energy heavy-ion beams were achieved at the Bevatron. Deuteron, alpha and nitrogen beams were accelerated and extracted at beam energies between 250 MeV/nucleon and 2.1 GeV/nucleon. During the past year, significant improvements have been made in the Bevatron heavy-ion capability. Extracted beam intensities have been increased a factor greater than ten. Carbon beams of intensity up to 10^8 particles per pulse have been obtained. High intensity oxygen and neon beams of modest intensity have also been achieved. The marked success of this development program has been demonstrated by an immediate demand for experimental beam time. This past year the heavy-ion research program has accounted for about 20% of the Bevatron operating time. The program includes high-energy physics research in fields such as heavy-ion fragmentation, total cross-section measurements, study of collective effects, and the production and use of a monoenergetic neutron beam. A start has been made on a biophysical and biomedical program in the following areas: cancer research, brain research, radiation biology of space flight, biology of differentiation and development, and radiation genetics. (auth)

14729 USE OF ELECTRON ACCELERATORS FOR THE MODIFICATION OF TEXTILES. Bobeth, W.; Heger, A.; Paesller, H.; Orechov, V. D.; Gomozova, R. P.; Korableva, E. V.; Pismannik, K. D. (Akademie der Wissenschaften der DDR, Dresden. Inst. fuer Technologie der Fasern). Faserforsch. Textiltech.; 24: No. 10, 412-417(1973). (In German).

The development of highly effective electron accelerators provided the basis of technological application of radiochemical methods. The results obtained by cooperation of investigators in the USSR and GDR with two topics of investigation are described, which are of importance for the development of industrial methods for radiochemical finishing of textiles by use of electron accelerators. (INIS)

14730 PRESENT STATUS AND FUTURE PLAN OF KEK PROTON SYNCHROTRON. Nishikawa, T. (National Lab. for High Energy Physics, Oho, Japan). pp 157-167 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

The discussion of the KEK proton synchrotron includes the present status of construction covering the preinjector, the booster, Linac, the main synchrotron, experimental areas, and the future program. (JFP)

Auxiliaries and Components

14731 (KFK-EXT-3/74-9, pp C1-C12) OPERATING EXPERIENCES WITH THE FIRST CRYOSTAT OF THE SUPERCONDUCTING LINEAR ACCELERATOR IN THE 1.8°K, 300-W REFRIGERATOR. Lehmann, W. Apr 1974. (In German).

In test and operation of helium low-temperature devices for applied superconductivity.

In a prototype of a superconducting rf linear accelerator, protons were accelerated with an accelerator field strength of 1.2 MV/m. The cooling circuit designed for this purpose with the first He II cryostat at a 300 W, 1.8°K refrigerator plant has been operated experimentally for 2,000 hours. The operation data obtained for the cryostat in cryogenics- and vacuum-engineering are in conformity with specifications and allow the reliable use of the acceleration section. Following a short description of the cryostat, the method of cooling and the instrumentation of the cryostat long-term experience are reported. Finally, the prepared extension of the cryostat system is mentioned. (auth)

14732 (LBL-3417) DRIFT TUBE ALIGNMENT AND BEAM EMITTANCE CODES IN USE AT THE SuperHILAC. Spence, D. A. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Oct 1974. Contract W-7405-eng-48. 9p. (CONF-741001-39). Dep. NTIS $4.00.

From CUBE symposium; Livermore, California, USA (23 Oct 1974).

Two Fortran-IV codes in use at the SuperHILAC have been of significant value in optimizing the geometry of the accelerator and in evaluating the performance of the heavy ion beams. The first routine described is used to determine the existing root mean square deviation of the 210 internal drift tube quadrupoles fitted to a straight line or to a second-order quadratic. It then predicts the minimum number of drift tubes, and their identities, to be moved in order to attain a user-elected margin of error fit. Brief mention is made of the pulsed-wire alignment technique for the quadrupole positioning. The second program described is part of a data system which utilizes a PDP-8/I as a control device for the manipulation of beam-scanning hardware, and a CDC-6600 in an off-line interactive mode which gives the user maximum versatility in treating the raw data and displaying the results of calculations. The code portrays the transverse beam emittance figures and their transmission through the accelerator and transport lines. Also discussed are future plans which include on-line data reduction and CRT display by the PDP-8/I to enable the operators to optimize the tuning of the HILAC. (auth)

14733 (RL-74-133) COMPUTER AIDED DESIGN AT THE RUTHERFORD LABORATORY. Trowbridge, C. W. (Science Research Council, Chilton (UK). Rutherford Lab.). 27 Jun 1974. 21p. Dep. NTIS (US Sales Only) $4.25.

The use of computer aided techniques at the Rutherford Laboratory for determining design parameters is reviewed. Particular attention is given to the use of interactive graphics in the computation of magnetic fields. The limitations of the present system are discussed and some indications of future developments are given. (auth)

14734 (SAND-74-5270) 2 MV, MULTICHANNEL, OIL-DIELECTRIC, TRIGGERED SPARK GAP. Prestwich, K. R. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 22p. (CONF-741113-3). Dep. NTIS $4.25.

From international conference on energy storage, compression and switching; Turin, Italy (5 Nov 1974).

A 2 MV, low jitter (< 2 nsec), multichannel (~ 10 channels), oil-dielectric spark gap has been developed to be used for switching the transmission lines of proposed new relativistic electron beam (REB) accelerators with substantially increased peak power (10^{13} watts). The switch is designed for operation in a strip-line geometry with three 122 cm long electrodes, two smooth bars and one sharp-edged trigger blade. When a voltage pulse that rises to 1.5 MV in 20 nsec is applied to the trigger electrode, about 10 arcs will close simultaneously in 30 nsec with a standard deviation less than 2 nsec. Data are presented on the variation of the switch closure time with applied voltages. The spark gap was installed on one of two 22 Ω, 20 nsec strip transmission lines connected as a Blumlein during test. The Blumlein output voltage pulse risetime decreases with increasing number of switch channels (13 nsec with 2 channels to 5 nsec for 14 channels). Data are presented on operation of the switch with the trigger electrode location varied from 20 to 40 percent of the gap spacing from the ground electrode. The effects of the interelectrode capacitance and isolation resistance on the operation of the switch are discussed. Several types of electrodes have been tested. Design data for a prototype REB accelerator using twelve of these switches in parallel are presented. (auth)

14735 (SAND-74-5590) UNTRIGGERED MULTICHANNEL OIL SWITCHING. Johnson, D. L. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 16p. (CONF-741113-2). Dep. NTIS $4.00.

From international conference on energy storage, compression and switching; Turin, Italy (5 Nov 1974).

Experiments on a fast risetime, self-breakdown, multichannel oil switch (for high-voltage accelerators) have given an average switch risetime (10 to 90%) of 5.7 nsec and an average of 12 arc channels per pulse. The apparatus consisted of a 140 kJ Marx generator which charged an intermediate energy store, an SF_6 gas switch and a 44 Ω parallel plate Blumlein transmission line with a 120 cm long knife edge switch. Energy was transferred from the intermediate store to the Blumlein through the SF_6 switch and a series inductor. The inductor was varied to change the rate of voltage rise on the Blumlein and knife edge switch. Data are presented on the simultaneity of breakdown of two switches, the dependence of switch risetime and number of arc channels on dV/dt, and on comparisons with empirical oil breakdown formulae. (auth)

14736 MUON SHIELDING AROUND HIGH-ENERGY ELECTRON ACCELERATORS. I. Theory. Nelson, W. R.; Kase, K. R. (Stanford Linear Accelerator Center, Calif. (USA)). Nucl. Instrum. Methods; 120: No. 3, 401-411(15 Sep 1974).

The production of muons from a high-energy electron linac is calculated using the latest cross section theory. The shielding of these muons is calculated using the Fermi–Eyges multiple scattering formulation. The effect of various approximations in the calculations is discussed. A comparison is made between theory and experiment, and reasonable agreement is obtained in the forward direction. The experiment gives a significantly higher value for the absorbed dose, as compared to theory, for locations off the production axis. This is believed to be due to a background component in the total dose measured, and suggests the need for further experimentation with emphasis of fluence (as well as absorbed dose) measurements at distances far from the axis. (auth)

14737 MUON SHIELDING AROUND HIGH-ENERGY ELECTRON ACCELERATORS. II. Experimental Investigation. Nelson, W. R.; Kase, K. R.; Svensson, G. K. (Stanford Linear Accelerator Center, Calif. (USA)). Nucl. Instrum. Methods; 120: No. 3, 413-429(15 Sep 1974).

This paper describes and presents results of an experiment measuring the fluence and absorbed dose delivered by electron accelerator-produced muons penetrating thick iron shields. The experiment was designed to check the theoretical calculations described in the preceding paper. Nuclear track emulsions and scintillation counters were used to measure fluence and ^7LiF was used for the dose measurements. It is shown that the absorbed dose can be calculated from the fluence data by using a restricted stopping power. The results of the measurements indicate that the theoretical calculation accurately predicts the muon fluence and absorbed dose at small angles (<30 mrad) but underestimates both at large angles by an order of magnitude or more. Several possible explanations for this effect are discussed. (auth)

14738 ELECTROSTATIC SIGNAL ELECTRODES. Chapter I. Moskalev, V. A.; Shestakov, V. G. pp 8-26 of Kontrol' i Izmerenie Parametrov Puchkov Zaryazhennykh Chastits. Moscow; Atomizdat (1973). (In Russian).

This chapter systematizes the published material on calculation technique and systems for controlling and measuring charged particle beams in which the receivers are electrostatic signal electrodes. These systems are based on the measurement of the electrostatic potential created by a charged particle beam during its movement near or through the electrode. A description is given of systems that measure the intensity and position of a bunched beam, and of a system that measures the parameters of a nonbunched beam. Consideration is given to details of calibrating electrostatic signal electrodes. (tr-SJR)

14739 CONTROL SYSTEM FOR THE SPS. Crowley-Milling, M. C. (CERN, Geneva). pp 14-21 of Trudy Tret'ego Vsesoyuznogo Soveshchaniya po Uskoritelyam Zaryazhennykh Chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973).

From 3rd All-Union conference on charged particle accelerators; Moscow, USSR (1973).

In the paper the specific requirements for the control system for the SPS accelerator are pointed out. The multicomputer control system layout is described. The interface between the computers and the apparatus to be controlled will be through the CAMAC system. The role of an interpreter, a computer program for on-line subroutine linking and calling, in the computer software system is discussed, and the closed orbit control system is briefly described. (INIS)

14740 USE OF COMPUTERS FOR ACCELERATOR CONTROL. Keyser, R. (CERN, Geneva). pp 22-29 of Trudy Tret'ego Vsesoyuznogo Soveshchaniya po Uskoritelyam Zaryazhennykh Chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973).

From 3rd All-Union conference on charged particle accelerators; Moscow, USSR (1973).

Some problems in the development of a unified control system are discussed. The application of the computer control to the ISR accelerator is described. Finally, some general trends in computer control are noted. (INIS)

14741 PRINCIPLES FOR DESIGNING THE MAIN UNITS OF THE DIGITAL DEVICES FOR INVESTIGATING PULSED PROCESSES AND MEASURING THE BEAM PARAMETERS IN CHARGED PARTICLE ACCELERATORS. Gerasimov, V. P.; Kolesov, S. Ya.; Ol'khovikov, L. V.; Repin, S. S.; Skosarev, V. A. (Scientific-Research Inst. of Electrophysical Equipment, Leningrad). pp 30-34 of Trudy Tret'ego Vsesoyuznogo Soveshchaniya po Uskoritelyam Zaryazhennykh Chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd All-Union conference on charged particle accelerators; Moscow, USSR (1973).

This paper considers circuit features of inlet compatible amplifiers, linear gating circuits, an analog memory circuit, analogue subtraction of precision pulse digital voltmeters and digital normalization units for systems measuring the position of a beam. (tr-SJR)

14742 PROBLEMS IN CONVERSION OF DATA ON ACCELERATOR BEAM PARAMETERS FOR A CONTROL COMPUTER. Armenskii, E. V.; Borodulin, A. I.; Emel'yanov, V. K.; Rybin, V. M.; Tsyplakov, A. P. (Moscow Engineering-Physics Inst.). pp 35-38 of Trudy Tret'ego Vsesoyuznogo Soveshchaniya po Uskoritelyam Zaryazhennykh Chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd All-Union conference on charged particle accelerators; Moscow, USSR (1973).

This paper enumerates the requirements of converters intended for operation in systems of automatic control and measurements of beam parameters in charged-particle accelerators. An attempt is made to classify converters most completely satisfying these requirements according to the physical principle lying at the base of the information converter. A review is given on the possibilities of obtaining information on the parameters and characteristics of charged-particle beams (current or beam intensity, average energy and energy spectrum of the beam, beam profile, position of the beam, emittance) by means of some type of converter, and the degree of action of the converter on the beam. It is shown that the most universal is a converter of the electro-acoustic type. (tr-SJR)

14743 PERFORMANCE OF LAMPF COMPUTER CONTROL SYSTEM. Butler, H. S. (Los Alamos Scientific Lab., NM). pp 46-55 of Trudy Tret'ego Vsesoyuznogo Soveshchaniya po Uskoritelyam Zaryazhennykh Chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973).

From 3rd All-Union conference on charged particle accelerators; Moscow, USSR (1973).

The paper describes the LAMPF computer control system, the way it functions and the manner in which an operator uses the system from the central control room. The paper discusses several application programs that have had an important impact on the operation of the facility. They are as follows: a program

for diagnosing equipment failures, a program to facilitate beam diagnostic studies, and a program for studying the beam dynamics. The programs have been written in the FORTRAN language. The control system has been used to deliver a beam to the switchyard and guide it through a string of bending magnets for momentum analysis. (INIS)

14744 AUTOMATIC CONTROL OF AN A. V. F. CYCLOTRON. Hagedoorn, H. L.; Heusden, G. C.; Marchand, J. F.; Schutte, F. pp 56-74 of Trudy Tret'ego Vsesoyuznogo Soveshchaniya po Uskoritelyam Zaryazhennykh Chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973).

From 3rd All-Union conference on charged particle accelerators; Moscow, USSR (1973).

The paper briefly describes the development of an automatic control system based on measuring the beam properties and feeding the measured data to an on-line computer. The data are compared with required values and the computer calculates the corrections of all parameters and automatically performs the adjustments. The control system is under construction at the Eindhoven University of Technology Cyclotron Laboratory. The cyclotron parameters and the beam properties are classified into several categories and some beam properties to be measured are pointed out. A description of the mathematical treatment of data by the computer is given and the dependences of the beam properties on isochronism for a proton beam of 7 MeV are discussed. Finally, the CAMAC data handling system used is briefly reviewed. (INIS)

14745 POSSIBLE VARIANT FOR AUTOMATIC CONTROL OF SYNCHROTRONS AT HIGH AND VERY HIGH ENERGIES. Karabekov, I. P.; Krol, V. K.; Buyukyan, S. P.; Ovakimyan, S. S.; Martirosyan, M. A.; Nazaryan, Yu. R. (Erevan Inst. of Physics). pp 77-81 of Trudy Tret'ego Vsesoyuznogo Soveshchaniya po Uskoritelyam Zaryazhennykh Chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd All-Union conference on charged particle accelerators; Moscow, USSR (1973).

This study considers a variant for the automatic control of an electron synchrotron, which is based on introducing a system for spacial correction of magnet position from information of the beam and self-balancing circuits which eliminate errors in the control field and gradient arising for a number of reasons. Results are presented on a study of the self-balancing system, in particular, the results of suppressing by the self-balancing circuits the phase shifts between magnetic fluxes in separate units. (tr-SJR)

14746 AUTOMATIC POWER SUPPLY SYSTEM FOR THE DRIFT TUBES OF LINEAR INJECTOR ACCELERATOR OF A PROTON SYNCHROTRON BOOSTER. Alekseev, V. A.; Vasil'ev, V. S.; Gerasimov, V. P.; Gordin, V. I.; Gusev, O. A.; Il'in, B. N. (Inst. of Electrophysical Equipment, Leningrad). pp 82-86 of Trudy Tret'ego Vsesoyuznogo Soveshchaniya po Uskoritelyam Zaryazhennykh Chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd All-Union conference on charged particle accelerators; Moscow, USSR (1973).

This paper presents the primary technical data and describes schematically an automated complex consisting of 95 feed systems for the drift tubes of a linear accelerator. Reliability of the complex is assured by the use of identical feed systems and by keeping the feed systems in standby. Program control of the system is carried out from a central panel by selection of a program. In this case, the necessary number of the drift tube is chosen from the address selection unit. By means of an information unit, which includes within itself an electronic commutator for subsequent interrogation, it is possible to control the amplitudes of current pulses and to deliver a signal to an indicator unit. Startup of all systems is carried out by pulses which are generated by a synchronizer. This complex assures operability and control of the feed systems. (tr-SJR)

14747 DEVELOPMENT OF CYBERNETIC CONTROL METHODS FOR HIGH-ENERGY ACCELERATORS. Vasil'ev, A. A. (Radiotechnical Inst., Moscow). pp 4-13; 91-92 of Trudy Tret'ego Vsesoyuznogo Soveshchaniya po Uskoritelyam Zaryazhennykh Chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd All-Union conference on the charged particle accelerators; Moscow, USSR (1973).

This study considers requirements (multifunctionality, reliability, freedom from error and others) imposed on computers intended for use in systems of data collection and control of very high-energy accelerators. Examples are presented of computer use in systems controlling a closed orbit and regulating the entry conditions and parameters of the beam extraction system. A centralized accelerator control system with autonomous subsystems of control are also considered. (tr-SJR)

14748 IMPROVEMENTS IN THE DEVICES WHICH MEASURE THE PARAMETERS OF THE BEAM EXTRACTED FROM THE EREVAN 6 GeV ELECTRON SYNCHROTRON. Karabekov, I. P.; Martirosyan, M. A.; Esin, S. K.; Ovakimyan, S. S.; Nazaryan, Yu. P.; Arakelyan, G. A.; Kotsinyan, A. M. (Erevan Inst. of Physics). pp 136-139 of Trudy Tret'ego Vsesoyuznogo Soveshchaniya po Uskoritelyam Zaryazhennykh Chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd All-Union conference on charged particle accelerators; Moscow, USSR (1973).

This study presents the results of an experimental study of newly perfected recorders for external beams, and methods of designing and building these recorders. Consideration is given to a monitor of the position of a gamma-beam with internal subtraction and to monitors of secondary emission with multiplication. The monitor of the gamma-beam position is an ionization chamber having a one-piece, collecting electrode and symmetrically sectioned off, high-voltage electrodes, to which the same potentials of opposite signs are supplied. The secondary emission monitors are made up of commercial photomultipliers. (tr-SJR)

14749 USE FEATURES OF ACCELERATING WAVEGUIDES IN THE SUPERHIGH ENERGY PROTON SYNCHROTRON. Volodin, V. A.; Shal'nov, A. V. (Moscow Engineering-Physics Inst.). pp 140-143 of Trudy Tret'ego Vsesoyuznogo Soveshchaniya po Uskoritelyam Zaryazhennykh Chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd All-Union conference on the charged particle accelerators; Moscow, USSR (1973).

This report describes a theoretical study of the possibility of using in a 1000 GeV proton synchrotron as accelerating elements unaltered accelerating waveguides which are sections of periodic or close-to-periodic structures in which a wave is propagated with a phase velocity close to the velocity of light in free space. Consideration is given to the basic properties of accelerating waveguides loaded by an intense beam of charged particles. On the basis of a theory developed by the authors, an analysis is carried out on current loading of homogeneous and inhomogeneous accelerating waveguides in the presence of particle slip according to phase and for an arbitrary arrangement of particle bundles with respect to the accelerating wave. An example of a design of an optimal accelerating waveguide is proposed. (tr-SJR)

14750 DYNAMIC MEASUREMENTS OF THE RADIAL DIMENSIONS OF A BEAM IN A PROTON SYNCHROTRON BY RESIDUAL GAS IONIZATION. Kur'min, A. A. (Radiotechnical Inst., Moscow); Elyan, V. V.; Mamaev, G. L.; Gertsev, K. F. pp 144-147 of Trudy Tret'ego Vsesoyuznogo Soveshchaniya po Uskoritelyam Zaryazhennykh Chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd All-Union conference on charged particle accelerators; Moscow, USSR (1973).

This report describes measurements on the radial dimensions of a beam in the Serpukhov ring accelerator by means of an ionization profilometer. The profilometer contains two identical channels in order to obtain orthogonal projections of proton distribution in the radial cross-section of the beam. A block diagram of the equipment of one of the channels is presented. The measuring part of the channel is made of small-size, noncumulative LI-605-1 transmitting tubes. The measuring part carries the scanning of the optical image and transmission of the electrical signal obtained to the control room. Displays are used to compact the information in time and for visualizing the information. Operation of the profilometer is illustrated by oscillograms of the radial distribution of protons at different rates of scanning. (tr-SJR)

14751 ION PROBE FOR MEASURING PROTON BEAM PARAMETERS. Lipatov, E. F.; Malyukin, L. A.; Onosovskii, K. K. (Inst. of Theoretical and Experimental Physics, Moscow). pp 148-150 of Trudy Tret'ego Vsesoyuznogo Soveshchaniya po Uskoritelyam Zaryazhennykh Chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd All-Union conference on charged particle accelerators; Moscow, USSR (1973).

This paper describes studies on the development of a recorder which is based on measuring the ionization of a residual gas by a proton beam with the purpose of obtaining information on the radial dimensions, the position and intensity of the accelerated beam. Features of the recorder are described. Its resolution is determined. (tr-SJR)

14752 ACCELERATOR SAFETY LOGIC CIRCUITS. Galkin, B. S.; Gerasimov, V. P.; Gusev, O. A.; Kolesov, S. Ya.; Skosarev, V. A.; Travkin, V. G. (Inst. of Electrophysical Equipment, Leningrad). pp 151-153 of Trudy Tret'ego Vsesoyuznogo Soveshchaniya po Uskoritelyam Zaryazhennykh Chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd All-Union conference on charged particle accelerators; Moscow, USSR (1973).

This study describes accelerator emergency protection systems made up of logic circuits. A scheme for the automated control of extraction channels in a proton synchrotron and systems for the control of accelerating equipment in a linear induction accelerator are considered as examples. (tr-SJR)

14753 RECONSTRUCTION OF THE EREVAN ELECTRON SYNCHROTRON VACUUM SYSTEM. Martyugov, G. M. (Inst. of Electrophysical Equipment, Leningrad); Mud'yugin, B. G.; Popkovich, A. V.; Fefelov, P. A.; Dokhikyan, K. A.; Egiazaryan, A. A.; Esin, S. K.; Mkrtchan, Kh. P.; Khanamiryan, E. A. pp 227-230 of Trudy Tret'ego Vsesoyuznogo Soveshchaniya po Uskoritelyam Zaryazhennykh Chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd All-Union conference on charged particle accelerators; Moscow, USSR (1973).

This paper briefly describes features of ceramic sections of the vacuum chamber of the Erevan electron synchrotron, which were installed in place of the former metal-epoxy sections in order to increase the reliability of the vacuum system. The method of testing is described, and the results of testing the ceramic sections for vacuum tightness are presented. The results of putting the synchrotron into operation after modifying the vacuum system are presented. (tr-SJR)

14754 CONVERSION OF THE KAZAKHSTAN CYCLOTRON TO AN ISOCHRONOUS CYCLOTRON WITH REGULATED ION ENERGY. Arzumanov, A. A.; Nemenov, L. M.; Batalin, S. S.; Volkov, B. A.; Nigmatov, M. Kh.; Rybin, S. N. (Inst. of Nuclear Physics, Alma-Ata, USSR). pp 231-235 of Trudy tret'ego Vsesoyuznogo soveshchaniya po uskoritelyam zaryazhennykh chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd all-union conference on charged particle accelerators; Moscow, USSR (1973).

This study describes the results of investigating beam dynamics in sectored magnetic fields, which were carried out in connection with the conversion of the Kazakhstan cyclotron to isochronous mode of operation with regulated ion energy. The results of a study of the magnetic system of the isochronous cyclotron are presented. A three-sectored, weakly-spiral structure of the pole surface with a constant thickness of the sectors was selected. The studies showed that the ion energy could be changed over wide limits by means of 10 pairs of circular windings with the number of ampere-windings being changed from 6750 for the inner surface to 2400 for the outer surface. A general view of the unit is shown. (tr-SJR)

14755 MODIFYING THE EHKU-6 ACCELERATION SYSTEM FOR PERFORMANCE WITH SLOW EXTRACTION. Davydov, M. S. (Scientific-Research Inst. of Electrophysical Equipment, Leningrad); Levin, V. M.; Finkel'shtein, I. I.; Baryshev, A. I.; Esin, S. K. pp 249-252 of Trudy tret'ego Vsesoyuznogo soveshchaniya po uskoritelyam zaryazhennykh chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd all-union conference on charged particle accelerators; Moscow, USSR (1973).

This paper presents the results of studies directed to developing a powerful system of high frequency feed for extracting a beam of electrons with a maximum energy of 6 GeV in a period of 4 msec, and also the results of investigating the possibility of using resonators at beam energies up to 7.5 GeV. It is proposed that the power of the high-frequency feed system be increased by turning on an additional power amplifier GI-24A between each of the accelerating resonators and the main feed supplying it. A block diagram of the high-frequency feed system is presented. (tr-SJR)

14756 CHOICE OF THE COMPOSITION AND METHODS OF COATING, AND STUDIES OF THE PROPERTIES OF RESISTIVE COATINGS, FOR THE ACCELERATING TUBE OF A LINEAR INDUCTION ACCELERATOR. Alekseev, R. A.; Antipov, V. F.; Bogdanov, O. S.; Vakhrushir, Yu. P.; Gagen-Torn, V. K.; Ikonnikova, A. S.; Zaitova, L. N.; Kiselev, A. P.; Konstantinov, Yu. A.; Taskina, T. A.; Fedorova, V. K. (Inst. of Electrophysical Equipment, Leningrad). pp 253-256 of Trudy tret'ego Vsesoyuznogo soveshchaniya po uskoritelyam zaryazhennykh chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd all-union conference on charged particle accelerators; Moscow, USSR (1973).

Studies are described on the selection of an electrically-conducting coating for the inner surface of the accelerating tube of a linear, induction electron accelerator in order to assure outflow of charge striking this surface. Results are presented of a study of the electrical properties of stannate coverings having different compositions (based on: $SnO_2 + Sb_2O_5$; $SnO_2 + Sb_2O_3 + ZnO$; $SnO_2 + BiSO_3$; $SnO_2 + Sb_2O_3 + Bi_2O_3$), and having a different content of initial components which are applied by the methods of pulverization and pyrolysis of chlorides of tin, antimony and other coating elements. An analysis of the results showed that from the standpoint of electrical characteristics the most acceptable was a stannate covering with a bismuth additive applied to the surface by the method of pulverization. (tr-SJR)

14757 PULSE POWER SUPPLY SYSTEM FOR THE CYCLOTRON ELECTROSTATIC DEFLECTORS WITH STABILIZATION OF THE TIME POSITION OF THE FORMED PULSES. Gerasimov, V. P.; Istomin, Yu. A.; Markov, V. B.; Mellekh, E. M.; Pavlov, E. P. (Scientific-Research Inst. of Electrophysical Equipment, Leningrad). pp 257-261 of Trudy tret'ego Vsesoyuznogo soveshchaniya po uskoritelyam zaryazhennykh chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd all-union conference on charged particle accelerators; Moscow, USSR (1973).

This paper describes the theory and circuits of a pulse feed system for the electrostatic deflectors of a cyclotron with stabilization of the time position of the formed pulses. The system includes within itself a modulator of the "outside" deflector, a modulator of the "inside" deflector and a circuit for stabilizing the time position of the pulses formed in the deflectors, (tr-SJR).

14758 SYSTEM FOR SUPPRESSING MAGNETIC FIELD PULSATIONS OF THE DUBNA SYNCHROCYCLOTRON. Smirnov, A. A.; Doroshenko, A. Z.; Kalmykov, D. P. (Joint Inst. for Nuclear Research, Dubna, USSR). pp 266-269 of Trudy tret'ego Vsesoyuznogo soveshchaniya po uskoritelyam zaryazhennykh chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd all-union conference on the charged particle accelerators; Moscow, USSR (1973).

This report describes a scheme for suppressing magnetic field pulsations, which is based on a LC-filter that is turned on with charging of the filter condensers. In this scheme the filter is turned on by means of thyratrons only in the mode of a "current plateau". In order to decrease the power of the charged rectifier, an active resistance, which is necessary for stable burning of the thyratrons which were switched in, is switched in by means of an additional thyratron simultaneously with the thyratrons which were switched in. Thyratrons of the type TPI-85/15 are used. The pulsation suppression control scheme and a scheme for protecting the system from accidental excursions are described. Operation of the system showed the high reliability of all units. (tr-SJR)

Ion Sources and Injection and Extraction Systems

Refer also to abstract 15030.

14759 (CONF-741112-4) RECENT PROGRESS OF THE ZERO GRADIENT SYNCHROTRON BOOSTER. Simpson, J. D. (Argonne National Lab., Ill. (USA)). [nd] 6p. Dep. NTIS $4.00.

From fourth all-union national conference on charged particle accelerators; Moscow, USSR (18 Nov 1974).

The development phase of a project which will provide a rapid cycling booster injector synchrotron for the Zero Gradient Synchrotron (ZGS) is complete. A unique and important feature of the booster is its use of stripping injection. This required the development of an operational, moderately intense H^- ion source plus special injection equipment and techniques. A 500 MeV synchrotron is currently under construction and will replace the existing 200 MeV development machine. Details of the booster program, equipment, and operating experience are discussed. (auth)

14760 (JINR-9-7127) MEASUREMENT OF EFFICIENCY OF SLOW BEAM EXTRACTION FROM SYNCHROPHASOTRON. Gvozdev, V. Ya.; Zaitsev, L. N.; Issinskii, I. B.; Kryachko, A. P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1973. 8p. (In Russian). INIS.

A description is given of a new method of measuring the efficiency of beam extraction from accelerators, which is based on measuring the flux of secondary particles emitted by the accelerator. During operation of the extraction system the counters record a magnitude which corresponds to the fraction of the beam not extracted from the accelerator, and on cutting off the system a determination is made of the total intensity of the accelerated beam. (7 refs.) (tr-SJR)

14761 (JINR-9-7498) ANALYTICAL SOLUTION AND EVALUATING PARAMETERS OF THE BEAM SLOW EXTRAC-

TION SYSTEM FROM JINR SYNCHROPHASOTRON. Vasilishin, B. V.; Issinskii, I. B.; Mikhailov, V. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1973. 32p. (In Russian). INIS.

The properties of the resonance $\nu_x = 2/3$ were studied and the derivation characteristics in the use of perturbations of the form $b_2X^2 \sin 2\theta$ and $b_4X^4 \sin 2\theta$ were examined. The effect of the stabilizing nonlinearity was studied. On the basis of the results obtained, the characteristics of the extracted beam in the JINR synchrophasotron and of the parameters of the elements of the extraction system were calculated. The pulsation tolerances in the power system were evaluated, and the effect of pulse spread was studied. Some effects connected with the non-stationarity of the field index were considered. (tr-auth)

14762 (JINR-P9-8256) FORMING OF A MAGNETIC FIELD OF AN ELECTRON MODEL OF A RING CYCLOTRON FOR PARTICLE EXTRACTION BY THE METHOD OF CLOSED ORBIT EXPANSION. Vasilenko, A. T.; Zaplatin, N. L.; Komissarov, A. G.; Morozov, N. A.; Samsonov, E. V.; Shishlyannikov, P. T. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 13p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The results of experiments on forming of the magnetic field of an electron model of a cyclotron are presented. The experimental data are compared with the calculated data. The reasons for the appearance of the perturbations in the field configuration are analyzed. (auth)

14763 (JINR-P9-8257) CHOOSING OF THE PARAMETERS OF THE MAGNETIC SYSTEM FOR PARTICLE EXTRACTION FROM THE RING CYCLOTRON ELECTRON MODEL BY THE METHOD OF CLOSED ORBIT EXPANSION. Zaplatin, N. L.; Samsonov, E. V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 20p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Results are presented of calculations for choosing the parameters of complementary windings of the model to create the required changing in the magnetic field variations at final radii. The analysis of possible perturbations arising from different elements of the current system is performed. The suggested system of concentric windings allows the average magnetic field to be formed more accurately. (auth)

14764 (ORNL-tr-2879) PRODUCTION OF CARBON AND NITROGEN NUCLEI AND MULTICHARGED ARGON AND XENON IONS IN THE ELECTRON BEAM ION SOURCE. Donets, E. D.; Pikin, A. I. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1974. Translation by Martha Gerrard of JINR-P7-7999. 14p. Dep. NTIS $4.00.

The design parameters, operation, and performance of the KRION (cryogenic ionizer) ion source, which is a cryogenic variant of the electron-beam multicharged ion source, are described. Experimental results are presented and discussed for the ionization of xenon, argon, nitrogen, and carbon. (WHK)

14765 A PULSED SOURCE OF SPIN-POLARIZED ELECTRONS BY PHOTOEMISSION FROM EuO. Garwin, E. (Stanford Linear Accelerator Center, Calif. (USA)); Meier, F.; Pierce, D. T.; Sattler, K.; Siegmann, H. C. (Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Festkoerperphysik). Nucl. Instrum. Methods; 120: No. 3, 483-488(15 Sep 1974).

It is experimentally demonstrated that a light pulse of 1 μs duration and $\gtrsim$10 W peak power striking the surface of ferromagnetic EuO held at ~10°K does not adversely affect the spin polarization of photoelectrons emitted from this material. It is thus possible to obtain a pulsed beam of polarized electrons suited for injection into a high-energy accelerator. It is expected that considerably more than 10^9 electrons/pulse with a polarization of 80% can be obtained, with emittance $\leq$7 mrad cm as required for linear accelerators. (auth)

14766 A LAMB-SHIFT POLARIZED ION SOURCE FOR THE TUNL TANDEM ACCELERATOR. Clegg, T. B.; Bissinger, G. A.; Trainor, T. A. (North Carolina Univ., Chapel Hill (USA). Dept. of Physics). Nucl. Instrum. Methods; 120: No. 3, 445-464(15 Sep 1974).

Construction details and operating conditions are given for the Lamb-shift polarized ion source installed at TUNL. A spin filter is used to polarize the metastable hydrogen or deuterium beam. (auth)

14767 INTEGRATED SYSTEM FOR INCREASING THE DURATION AND FOR RAPID DUMPING OF THE SYNCHROCYCLOTRON PROTON BEAM. Abrosimov, N. K.; Devyaterikov, R. P.; Kotov, A. G.; Kulikov, A. V.; Mikheev, G. F.; Chernov, N. N.; Yurchenko, V. I. (Inst. of Nuclear Physics, Leningrad). pp 94-98 of Trudy tret'ego Vsesoyuznogo soveshchaniya po uskoritelyam zaryazhennykh chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd all-union conference on charged particle accelerators; Moscow, USSR (1973).

The details of an integrated system used for increasing the duration of a macroimpulse of a proton beam and for rapid dumping of the beam to an internal target of the synchrocyclotron is described. A schematic diagram of the system is presented. Parameters of the extended beam are given, and the operation of the synchrotron is described when operating in the mode of rapid dumping. (tr-SJR).

14768 SYSTEM FOR BEAM EXTRACTION FROM A SYNCHROCYCLOTRON WITH SPATIAL VARIATION OF THE MAGNETIC FIELD BY MEANS OF AN IRON-CURRENT CHANNEL. Vorozhtsov, S. B.; Dmitrievskii, V. P.; Zaplatin, N. L.; Leshchenko, G. P.; Chesnov, A. F. (Joint Inst. for Nuclear Research, Dubna, USSR). pp 99-103 of Trudy tret'ego Vsesoyuznogo soveshchaniya po uskoritelyam zaryazhennykh chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd all-union conference on the charged particle accelerators; Moscow, USSR (1973).

This study presents the basic results on selecting the parameters of the regenerative oscillation system and the magnetic deflection channel. Experimental values of the average components and of the harmonic amplitudes of the magnetic field are presented. Calculation of the beam envelope on its passage in the channel and through the boundary magnetic field of the accelerator showed that by proper choice of magnetic field gradients it is possible to decrease the radial dimensions of the beam. (tr-SJR)

14769 PRESENT STATUS OF THE DEVELOPMENT OF SLOW BEAM EXTRACTION FROM THE JINR SYNCHROCYCLOTRON. Averichev, S. A.; Buldakovskii, V. N.; Vasilishin, B. V. (Joint Inst. for Nuclear Research, Dubna, USSR). pp 104-109 of Trudy tret'ego Vsesoyuznogo soveshchaniya po uskoritelyam zaryazhennykh chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd all-union conference on charged particle accelerators; Moscow, USSR (1973).

This study considers a system of resonance beam extraction, by means of which it is possible to extract at least 90% of the accelerated beam. Design parameters of the system are presented, and a description of the equipment is given (of the septum-magnet, of the magnet and lens of the second internal step of removal, of the feed sources and other parts). Tuning of the system is considered. Operations to determine the efficiency of the system have not yet been completed, but measurements show that the efficiency may be greater than 90%. (tr-SJR)

14770 EXTERNAL RESONANCE MULTI-REVOLUTION INJECTION INTO A RING ACCELERATOR. Gromov, A. M.; Cherenkov, P. A. (Inst. of Physics, Moscow). pp 110-117 of Trudy tret'ego Vsesoyuznogo soveshchaniya po uskoritelyam zaryazhennykh chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd all-union conference on charged particle accelerators; Moscow, USSR (1973).

This study considers a resonance method of multi-revolution injection, in which the particles are drained off from the injection unit on the first revolutions in the vertical direction. In order to accomplish the multi-revolution injection a special magnetic channel with current compensation for magnetic field distortion was developed. A theoretical analysis of the particle injection is given. Experimental data obtained on the FIAN cyclotron on multi-revolution injection with the use of resonance of the bond between betatron oscillations showed that injection takes place in correspondence with the calculations which were carried out. (tr-SJR)

14771 IMPROVEMENTS IN THE MAGNETIC FIELD CONTROL OF PROTON SYNCHROTRONS FOR SLOW BEAM EXTRACTION. Gusev, A. M. (Scientific-Research Inst. of Electrophysical Equipment, Leningrad); Gusev, O. A.; Kornakov, E. V. pp 118-121 of Trudy tret'ego Vsesoyuznogo soveshchaniya po uskoritelyam zaryazhennykh chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd all-union conference on charged particle accelerators; Moscow, USSR (1973).

This study discusses methods of increasing the quality of regulating the magnetic field of proton synchrotrons with the purpose of attaining slow beam extraction. A simplified circuit of a control system with the required degree of control is presented for the ITEP synchrotron. Equipment used in the system is described. A discussion is presented on the prospects of use in systems which regulate high-current, high-power units of sectioned thyristor converters with integrated control. (tr-SJR)

14772 SYSTEM FOR THE UNIFORM EXTRACTION OF CHARGED PARTICLES FROM THE EREVAN SYNCHROTRON. Esin, S. K.; Kovalenko, V. I.; Markar'yan, A. A.; Perel'man, M. A.; Sadoyan, K. A. (Erevan Inst. of Physics). pp 130-132 of Trudy tret'ego Vsesoyuznogo soveshchaniya po uskoritelyam zaryazhennykh chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd all-union conference on charged particle accelerators; Moscow, USSR (1973).

This paper describes the principle of operation and features of a system for beam removal from the Erevan synchrotron, which automatically stabilizes the duration and steadiness of the extended withdrawal by correcting the rate of displacement of the orbit of the accelerated electrons at the moment of striking the target. The possibility of stabilizing the duration of the extended beam or the amplitude value of the extended withdrawal is foreseen. Operation of the stabilization scheme is illustrated by oscillograms. (tr-SJR).

14773 FURTHER STUDIES ON RESONANT EXTRACTION. Conte, M.; Liberti, G. (Univ., Genoa). pp 154-159 of Trudy tret'ego Vsesoyuznogo soveshchaniya po uskoritelyam zaryazhennykh chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973).

From 3rd all-union conference on charged particle accelerators; Moscow, USSR (1973).

The paper describes the analytical solution of the problem of the beam extraction from synchrotrons by tuning proper nonlinear resonances. The results obtained with the method described are compared with the results obtainable by direct numerical computation. (INIS)

14774 FAST EXTRACTION OF PROTONS FROM A 70 GeV ACCELERATOR FOR THE LIQUID-HYDROGEN CHAMBER MIRABEL. Aseev, A. A. (Inst. of High Energy Physics, Serpukhov, USSR); Afonin, A. G.; Drozhdin, A. I. pp 160-173 of Trudy tret'ego Vsesoyuznogo soveshchaniya po uskoritelyam zaryazhennykh chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd all-union conference on charged particle accelerators; Moscow, USSR (1973).

This study considers a scheme of fast removal of a beam from the Serpukhov synchrotron for the liquid-hydrogen chambers "Mirabel" and "Ludmilla". The basic characteristics and design parameters of the lens and magnets of the fast removal system are presented. A description is given of features of main elements of the removal system (of the shock magnet and the septum magnets). Features of the diagnostics system and of the beam transport system are described. Results of tuning the removal system are presented. (tr-SJR)

14775 RESULTS FROM THE RUNNING-IN OF THE CERN 800 MeV PS BOOSTER. pp 240-248 of Trudy tret'ego Vsesoyuznogo soveshchaniya po uskoritelyam zaryazhennykh chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973).

From 3rd all-union conference on charged particle accelerators; Moscow, USSR (1973).

The report covers the experiments and experience obtained with the CERN 800 MeV PS booster. The beam injection, acceleration, ejection, and recombination have been analyzed and the performance of the magnet system, acceleration system, and the beam observation systems have been evaluated. (INIS)

14776 TITANIUM-PUMP SYSTEM FOR HYDROGEN. Mirzoev, K. G.; Rogozinskii, V. G.; Ushkov, V. L. Sov. Phys.-Tech. Phys. (Engl. Transl.); 19: No. 3, 432-433(Sep 1974).

Translated from Zh. Tekh. Fiz.; 44: No. 3, 680-682(Mar 1974).

A study is reported of a vacuum system used to pump 1000 to 1500 $cm^3 \cdot atm/h$ of hydrogen in continuous flow through the ion source of the injector of an I-100 linear proton accelerator. The vacuum system consists of two NÉM-1T pumps and a getter pump, whose pumping rate is 10^4 liter/sec at $1 \cdot 10^{-6}$ torr. The system operates stably at a flow rate of up to 500 $cm^3 \cdot atm/h$ and at pressure below $1 \cdot 10^{-5}$ torr. In pulsed supply of hydrogen through the source at a rate of 0.125 Hz, the pumping is achieved by two NÉM-1T pumps at an average pressure of $1.6 \cdot 10^{-6}$ torr. Information obtained from extensive use of the NÉM-1T pumps to pump hydrogen in the pulsed mode is reported. (auth)

Ion Optics and Field Calculations

14777 (ISN-74-12) MANUAL FOR THE USE OF PARTICLE TRAJECTORIES PROGRAMS TO FIRST ORDER OF THE OPTIC SERIES. Ferme, J. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). 15 May 1974. 69p. (In French). INIS.

The OPTIC series programs have been used to calculate, to the first order, particle trajectories in optical systems composed of dipole and quadrupole magnets. These programs are adapted for use on a PDP 9 or PDP 15 computer with input/output by teletype. (INIS)

14778 (JINR-P9-8227) PHASING SYSTEM FOR A COLLECTIVE ACCELERATOR. Gavrilova, Z. G.; Ivanov, G. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1974. 22p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

The possibility of synchronizing the single clusters with the hf accelerating field phase is considered. As a phasing system a spiral waveguide with parameters $\beta = 0.2$ to 0.5, E = 5 to 10 kV/cm, and $\lambda = 2$ m is considered. The calculation of the phase trajectories, performed using a computer, has revealed the possibility of obtaining, at the mentioned parameters, the capture coefficient of 90%. The phase scattering value at the output of the system is 70°, the system length being 6 m. (auth)

14779 (LBL-3358) APPLICATION OF THE BRF SYSTEM TO SOME SUPERCONDUCTING MAGNET DESIGN PROBLEMS. Meuser, R. B. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 24 Oct 1974. Contract W-7405-eng-48. 8p. (CONF-741001-40). Dep. NTIS $4.00.

From CUBE symposium; Livermore, California, USA (23 Oct 1974).

The Berkeley Remote Facility (BRF) system—affected through a system of teletype terminals linked to the LBL computers—has been used to solve a large number of magnetic-field problems associated with the design and analysis of superconducting beam-transport magnets. The limitations of the BRF system are severe: total storage, 1000; 10 subscripted variables; no integer or complex arithmetic; no function or subroutine subprograms except those in its Spartan library; and a pidgin Fortran language. However, for fully 90% of our computational work, the low IQ of the BRF has been more than counter-balanced by its being on-line. The magnets we build have a long cylindrical aperture surrounded by arrays of longitudinal superconducting wires and iron arranged to produce a transverse field of prescribed shape, uniform fields for bending high energy charged particle beams, and quadrupole fields for focusing. The field in the aperture is expressed, usually, in terms of the coefficients of the Taylor's expansion—the "multipole coefficients". Point values of the field vector are also of interest, especially within the windings, as the magnitude of the field determines the allowable current. Many small programs have been developed to analyze both the two- and three-dimensional fields produced by various kinds of arrays of conductors. Some programs have the ability to vary a number of geometric parameters automatically in such a way as to drive the same number of multipole coefficients to zero. The on-line feature is especially handy, as such iterative calculations must often be cajoled into convergence. (auth)

14780 EMISSION OF RELATIVISTIC PARTICLES IN AN ONDULATOR WITH A SPIRAL MAGNETIC FIELD. Mussa, A. Kh.; Pavlenko, Yu. G.; Petukhov, V. I. Vestn. Mosk. Univ., Ser. III. Fiz. Astron.; 15: No. 3, 335-339(1974). (In Russian).

A study is made on the emission of electrons in an ondulator with a spiral magnetic field H = (–H sin ay, o, H cos ay), and it is shown that with increasing magnetic field strength the maximum in emission intensity is shifted from the first harmonic to the region of higher harmonics. (SJR)

14781 SPECIFIC FEATURES OF THE FEED SYSTEM FOR OPTICAL ELEMENTS MADE OF MAGNETIZED IRON. Alekseev, A. V.; Gubrienko, K. I.; Eremenko, E. V.; Kuznetsov, V. S.; Serebryakov, B. A. (Inst. of High Energy Physics, Serpukhov, USSR). pp 174-184 of Trudy tret'ego Vsesoyuznogo soveshchaniya po uskoritelyam zaryazhennykh chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd all-union conference on charged particle accelerators; Moscow, USSR (1973).

This study describes measures taken to increase the reliability, with a presentation of the parameters of rectifiers, of the BAKP-3200-12 type, which are used as feed sources of the focusing elements used for transport of a muon beam in an accelerator. A description is given of the current stabilization scheme of the BAKP units and of the equipment used to demagnetize the lens. (tr-SJR).

14782 TUNING THE HORIZONTAL FOCUSING OF THE ANALYZING PART OF SECONDARY BEAM CHANNELS. Miller, V. V. (Inst. of Theoretical and Experimental Physics, Moscow). pp 209-211 of Trudy tret'ego Vsesoyuznogo soveshchaniya po uskoritelyam zaryazhennykh chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd all-union conference on charged particle accelerators; Moscow, USSR (1973).

This study presents an analysis of the physics of the dependence of the finite image as a function of the tuning accuracy of the horizontal focusing of the analyzing part of the secondary beam channels. (tr-SJR)

14783 FEATURES OF HEAVY PARTICLE ACCELERATION IN THE JINR SYNCHROTRON. Kazanskii, G. S.; Mikhailov, A. I.; Puchkov, G. P. (Joint Inst. for Nuclear Research, Dubna, USSR). pp 236-239 of Trudy tret'ego Vsesoyuznogo soveshchaniya po uskoritelyam zaryazhennykh chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd all-union conference on charged particle accelerators; Moscow, USSR (1973).

This study presents the results of investigating the capture of heavy particles in the second stage of acceleration on the IOYaI synchrophasotron. The dynamics of particle motion in the phase plane are analyzed. Analysis and computer calculations showed that approximately 100% capture can be attained because of a jump change in the amplitude of the accelerating voltage in the course of the first semi-period of the small synchrotron oscillations. The effect of "the degree of constancy" of the magnetic field on the capture efficiency is shown. (tr-SJR)

Storage Rings

Refer also to abstract 15042.

14784 (BNL-19280) ISABELLE: SUPERCONDUCTING STORAGE ACCELERATOR. Barton, M. Q. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 9p. (CONF-741112-6). Dep. NTIS $4.00.

From 4th all-union national conference on charged particle accelerators; Moscow, USSR (18 Nov 1974).

Some parameters of the proposed ISABELLE superconducting storage ring facility are presented and discussed. (WHK)

14785 (BNL-19459) PRELIMINARY DESIGN OF EXPERIMENTAL INSERTIONS FOR VERTICALLY STACKED RINGS IN THE CERN 400 GeV STORAGE RING FACILITY. Chasman, R. W. (Brookhaven National Lab., Upton, N. Y. (USA)). Oct 1974. 16p. Dep. NTIS $4.00.

During the early design stages of the CERN 400 GeV storage ring facility the question arose as to whether the two rings should be horizontally or vertically stacked. In the discussions the straightforward assumption was made that the beams would cross horizontally if the two rings were placed on top of each other. Consequently, the design of both horizontal and vertical crossing experimental insertions and evaluation of their problem are important for the decision on the preferred physical stacking scheme. Preliminary results of the design work on possible vertical crossing insertions are given and some comparison is made. Three insertions aimed at fulfilling the experimental requirements were worked out, i.e., a high luminosity (low β) region, a high β region suitable for small angle scattering and a general purpose region with reduced luminosity, and a long free space at either side of the intersection point. (WHK)

14786 (CONF-740905-4) MOESSBAUER MEASUREMENTS WITHOUT CONVENTIONAL SOURCES? Ruby, S. L. (Argonne National Lab., Ill. (USA)). 1974. 11p. Dep. NTIS $4.00.

From international conference on the applications of the Moessbauer effect; Bendor, France (2 Sep 1974).

The possible use of the intense x-ray synchrotron radiation from the SPEAR storage ring for Moessbauer spectroscopy is discussed. The experimental apparatus required is described, and advantages of the proposal are given. (WHK)

14787 (RL-74-064) EPIC MAIN RING: THE CHEAPEST CURRENT DENSITY. Armstrong, A. G. (Science Research Council, Chilton (UK). Rutherford Lab.). 30 Apr 1974. 3p. (EPIC/MC-49). Dep. NTIS (US Sales Only) $4.00.

The dipoles in the EPIC main ring are the largest magnets in the machine: their total energy consumption and mass are some ten times as great as those of any other type in the ring, and it seems reasonable to begin by choosing the current density which will minimize the cost of the dipoles. Assumptions are stated, and the current density is derived on the basis of these assumptions. (auth)

14788 (RL-74-124) FEASIBILITY REPORT FOR A COLLIDING BEAM FACILITY-EPIC. (Science Research Council, Chilton (UK). Rutherford Lab.). Sep 1974. 128p. Dep. NTIS (US Sales Only) $9.50.

A summary of the studies carried out in 1973 on the physics potential and feasibility of electron-positron and electron-proton colliding beam machines is presented. The proposal complex could be built in stages. Stage I would be a single accelerator ring in which 14-GeV electrons collide with 14-GeV positrons counter-rotating within the same ring. Stage II could add, within the same tunnel, an additional magnet ring for protons. This would be sited above the electron ring and the two beams would be deflected to give e-p collisions in four regions. The proposed machine design and specifications are given, and the physics possibilities of the proposed machine are discussed. (WHK)

14789 PARTICLE TRAPPING DURING PASSAGE THROUGH A HIGH-ORDER NONLINEAR RESONANCE. Chao, A. W.; Month, M. (Brookhaven National Lab., Upton, N.Y. (USA)). Nucl. Instrum. Methods; 121: No. 1, 129-138(1 Oct 1974).

A theory of particle trapping and transport during a single passage through a high-order nonlinear resonance is developed for studying beam loss in the stacked coasting beam of the ISR. The main result is an expression for the trapping efficiency as a function of two scaling variables which are related to the resonance excitation width, the nonlinear detuning and the speed of passage through the resonance. The question of what phase-space region trapped particles are drawn from and the question of adiabaticity are discussed. The theory is then verified with a computer simulation for crossing a fifth order resonance. (auth)

14790 COMPUTER-CONTROLLED POWER SUPPLY SYSTEM FOR THE VEPP-3 ELECTROMAGNET AND LENSES. Baklakov, B. A.; Veremenko, V. F.; Karliner, M. M.; Kuper, E. A.; Nifontov, V. I.; Oreshkov, A. L.; Oshchepkov, Yu. I.; Petrov, S. P.; Protopopov, I. Ya. (Inst. of Nuclear Physics, Novosibirsk, USSR). pp 39-45 of Trudy tret'ego Vsesoyuznogo soveshchaniya po uskoritelyam zaryazhennykh chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd all-union conference on charged particle accelerators; Moscow, USSR (1973).

This paper describes the automated feed system of the electromagnets and quadrupole lenses of the VEPP-3 accumulator. This system is controlled by means of a computer and consists of digital and analogue parts. The digital part turns on the computer, the unit communicating with the computer, and the manual selection and address unit. The analogue part turns on the reference voltage source, the electromagnetic generator control unit, the electromagnetic generators, power loading and the shunts. Brief descriptions of these elements are presented, and the operating principle of the system is described. (tr-SJR)

14791 SOFTWARE OF THE COMPUTER CONTROL FOR THE VEPP-3 STORAGE RING. Levichev, B. V.; Mezentsev, N. A.; Perevedentsev, E. A.; Protopopov, I. Ya. (Inst. of Nuclear Physics, Novosibirsk, USSR). pp 75-76 of Trudy tret'ego Vsesoyuznogo soveshchaniya po uskoritelyam zaryazhennykh chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd all-union conference on charged particle accelerators; Moscow, USSR (1973).

This paper briefly describes the direction of development in creating an automated control system for the VEPP-3 accumulator of colliding electron-positron beams. The complex of programs which were developed assures retuning of the beams on going from an operating mode of a large phase volume of the accumulator during injection to an operating mode of a small beam size at the place of collision during the experiment. Particle energy in the accumulator is also measured with simultaneous measurement of the high-frequency voltage by turning on resonators of the 1st and 19th harmonics. Both programs operate in a real time scale. The program for increasing the energy is considered in greater detail. The system has been operating since 1971 from the "MINSK-22" computer. (tr-SJR)

14792 MAGNETIC MEASUREMENTS ON THE VAPP STORAGE RING. Voblyi, A. D.; Levichev, B. V.; Protopopov, I. Ya. (Inst. of Nuclear Physics, Novosibirsk, USSR). pp 87-90 of Trudy tret'ego Vsesoyuznogo soveshchaniya po uskoritelyam zaryazhennykh chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd all-union conference on the charged particle accelerators; Moscow, USSR (1973).

This paper describes the method of making magnetic measurements on the VAPP accumulator which contains more than 100 magnetic units. An automated measuring system was developed with registration of the measurement results in the memory of a computer. Planar Hall recorders were used as data receivers. The effect of saturation of residual fields and their gradients was studied. The measurement results are presented. (tr-SJR)

14793 SCHEME OF ELECTRON-OPTICAL CHANNELS FOR ELECTRON AND POSITRON INJECTION INTO THE VEPP-4 STORAGE RING. Vsevolozhskaya, T. A.; Sil'vestrov, G. I. (Inst. of Nuclear Physics, Novosibirsk, USSR). pp 122-125 of Trudy tret'ego Vsesoyuznogo soveshchaniya po uskoritelyam zaryazhennykh chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd all-union conference on the charged particle accelerators; Moscow, USSR (1973).

This study considers the scheme of the electron-optical channels of the VEPP-4 complex designed for three modes of injection: (1) injection of electrons and positrons from a B-4 synchrotron with energies up to 450 MeV at a pulse following frequency to a few cycles per second; (2) injection of electrons and positrons from a VEPP-3 accumulator with energies up to 1.8 GeV; and (3) injection of antiprotons (protons) from a NAP accumulator with a momentum of 1.8 GeV/c. In general for all three modes of operation the beam channel parts are led into the accumulator perpendicular to its linear stretch and are spread out to the opposite sides by two 90° turns in the horizontal plane with a simultaneous turning along the vertical at an angle of 10°. Each turn is carried out by two magnets having turning angles of ~45° and a homogeneous field, between which three quadrupole sections are placed. All channel elements are pulsed; cooling is absent. This scheme assures good compatibility of the emittance of the injected beam with the emittance of the accumulator. (tr-SJR)

14794 BEAM TRANSPORT AND EXTRACTION OF 1.35 GeV ELECTRONS FROM THE VEPP-3 STORAGE RING. Barkov, L. M.; Zolotarev, M. S.; Kiselev, V. A.; Pakin, V. N.; Perevedentsev, E. A.; Skrinskii, A. N.; Smakhtin, V. P.; Khlestov, V. B.; Shepelenko, A. A. (Inst. of Nuclear Physics, Novosibirsk, USSR). pp 126-129 of Trudy tret'ego Vsesoyuznogo soveshchaniya po uskoritelyam zaryazhennykh chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd all-union conference on charged particle accelerators; Moscow, USSR (1973).

This paper presents the requirements for extracting a 1.35 GeV electron beam from the VEPP-3 accumulator. The geometry of the beam extraction channel is shown in the vertical and horizontal planes, and the basic technical parameters of the channel elements are presented. Construction features of the pulse septum-magnet and of the pulse quadrupole lenses are considered. (tr-SJR)

14795 2 TeV ACCELERATOR-STORAGE COMPLEX. Ado, Yu. M. (Inst. of High Energy Physics, Serpukhov, USSR); Logunov, A. A.; Myaeh, E. A.; Naumov, A. A.; Tushabramishvili, K. Z.; Komar, E. G.; Monoszon, N. A.; Titov, V. A.; Shukeilo, I. A.; Vasil'ev, A. A.; Kuz'min, A. A.; Mironov, E. S.; Murin, B. P. pp 275-281; 310-311 of Trudy tret'ego Vsesoyuznogo soveshchaniya po uskoritelyam zaryazhennykh chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd all-union conference on charged particle accelerators; Moscow, USSR (1973).

The construction features and preliminary design parameters of an accelerator-storage complex at proton energies of 2 TeV are considered. The design is based on the use of superconducting magnets in the accelerator and beam channels. Construction details of superconducting magnets made of NbTi alloy are given. Preliminary data are presented for the superconducting magnet of the accelerator whose windings are cooled to 4.2°K with liquid helium. (tr-SJR)

14796 STATUS REPORT ON THE LBL-SLAC PROTON-ELECTRON-POSITRON COLLIDING BEAM PROJECT. pp 292-302 of Trudy tret'ego Vsesoyuznogo soveshchaniya po uskoritelyam zaryazhennykh chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973).

From 3rd all-union conference on charged particle accelerators; Moscow, USSR (1973).

The work of the joint LBL-SLAC study group on a proton-electron-positron colliding beam facility (PEP) is briefly described. Following a section on the physics which can be done on PEP, the guiding philosophy of the study is outlined, a first reasonably complete machine example is presented, and subjects which have been identified as requiring further study are delineated. (auth)

Experimental Facilities

Refer also to abstracts 13774, 14587, 15309, 15343, and 15344.

14797 (CEA-N-1718) DETERMINATION OF THE ABSOLUTE VALUES OF PHOTONUCLEAR CROSS SECTIONS AT A. L. S. Faure, J. L. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire). May 1974. 31p. (In French). Dept. NTIS (US Sales Only) $4.75.

The experimental setup used in the study of photonuclear reactions with the A. L. S. bremsstrahlung beam is described. For each element, the various calibrations and efficiency calculations are given; the shape and intensity of the photon spectrum are calculated. Results of the 90 deg center-of-mass differential cross section of π^0 photoproduction on the proton agree with those of previous experiments at Bonn. (auth)

14798 (FERMILAB-Conf-262) PARTICLE BEAMS AT PROTON ACCELERATORS. Sanford, J. R. (Fermi National Accelerator Lab., Batavia, Ill. (USA)). Sep 1974. 24p. (CONF-740463-4). Dep. NTIS $4.25.

From meeting of the American Physical Society; Washington, District of Columbia, USA (22 Apr 1974).

The operating parameters and experimental facilities of the Argonne ZGS, the Brookhaven AGS, and the Fermilab proton synchrotron are discussed and compared to review the resources available for high energy physics research. (WHK)

14799 (IPNO-RC-73-08) APPLICATION OF THE HELIUM JET TECHNIQUE TO THE ON-LINE IDENTIFICATION OF NEW NUCLEI FROM THEIR γ-RAY EMISSIONS. Deprun, C.; Gauvin, H.; Lagarde, B.; Le Beyec, Y. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1973. 17p. (In French). Dep. NTIS (US Sales Only) $4.00.

The helium-jet method is now used for collecting γ-emitting nuclei. The preliminary experimental results obtained using a ^{12}C ion beam from the Orsay heavy-ion cyclotron are presented together with the possible advances that might be made to the method. Studies of $^{103}Rh(^{12}C,xn)^{115-x}Sb$ reactions enabled ^{113}Sb, ^{112}Sb, ^{111}Sb and ^{110}Sb isotopes to be identified from their γ-ray emissions. These experiments provide a test of the method, the results of spectroscopic measurements for the neutron-deficient isotopes already established from (p,xn) reactions being reproduced. (FR)

14800 (JINR-9-7504) PROPOSED BEAM TRANSPORT SYSTEM FOR PHYSICAL EXPERIMENTS ON THE ISOCHRONOUS CYCLOTRON U-120M IN THE INSTITUTE OF NUCLEAR PHYSICS OF THE CZECHOSLOVAKIAN ACADEMY OF SCIENCES. Beishovets, V.; Zaplatin, N. L.; Krzhivanek, M.; Kuzmiyak, M.; Shimova, L.; Chesnova, S. I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1973. 13p. (In Russian). INIS.

This study presents a scheme of beam spreading and separation in the U-120M cyclotron of the Czechoslovakian Academy of Sciences. A presentation is made of the requirements of physicists in various departments of the institute with respect to the beam at target points, and the parameters of one of the variants of a magnetic analyzer are calculated. (4 refs) (tr-SJR)

14801 (JINR-9-7505) CALCULATION OF PROTON BEAM TRANSPORTATION PARAMETERS OF THE PHASOTRON WITH A SPATIAL VARIATION OF MAGNETIC FIELD (FACILITY "F"). Dmitrievskii, V. P.; Zaplatin, N. L.; Kropin, A. A.; Roganov, V. S.; Chesnova, S. I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1973. 27p. (In Russian). INIS.

A calculation is made of the beam emittance and of the optical parameters of the proton path in a synchrocyclotron having spacial variation of the magnetic field. A determination is made of optimal target thicknesses of different materials to generate π-mesons. (8 refs) (tr-SJR)

14802 (JINR-P9-8222) SYSTEM OF PROJECTED CHANNELS FOR BEAMS OF A PHASOTRON WITH THE MAGNETIC FIELD VARIATION. Dem'yanov, A. V.; Dzhelepov, V. P.; Zamolodchikov, B. I.; Kropin, A. A.; Roganov, V. S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 21p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

Channels for meson and nucleon beams of a high-current phasotron (equipment "Φ") are described. The data are presented on the ion optics parameters and on the internal and external targets projected for beams of a phasotron with the magnetic field variation. The data on characteristics of the projected particle beams are given. (auth)

14803 (LA-UR-74-1677) MEDICAL LINAC DESIGN POSSIBILITIES. Knapp, E. A.; Bradbury, J. N. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 10p. (CONF-741040-14). Dep. NTIS $4.00.

From 3rd conference on the use of small accelerators; Denton, Texas, USA (21 Oct 1974).

During the last five years a dramatic expansion of the uses of accelerator generated radiations in medicine has become possible. The application of resonant standing wave accelerator technology to conventional medical linac systems has brought them within the reach of hundreds of cancer treatment centers throughout the country. In addition the construction of meson factories will allow the use of secondary particle beams for cancer therapy. A brief discussion of the LAMPF linear accelerator is provided, including the properties of the side coupled accelerator system. Some design criteria for possible dedicated meson producing accelerator systems for hospital use are described. (auth)

14804 (ORO-3509-11) PROGRESS REPORT ON SPECIAL BEAMS FOR 15′ BUBBLE CHAMBER AS OF SEPTEMBER 25, 1974. Lannutti, J. E. (Florida State Univ., Tallahassee (USA). Dept. of Physics). 1974. 6p. Dep. NTIS $4.00.

Progress is reviewed on (1) the tagging system, (2) experimentation with enrichment schemes using present beams, and (3) design of higher acceptance system and a study of existing beams. (WHK)

14805 PREPARATION OF RUBIDIUM TARGETS FOR HIGH RESOLUTION REACTION SPECTROSCOPY. Hulstman, L.; Vis, R. D.; Blok, J. (Vrije Universiteit, Amsterdam (Netherlands). Natuurkundig Lab.). Nucl. Instrum. Methods; 120: No. 3, 537-538(15 Sep 1974).

Several methods to produce thin homogeneous rubidium targets have been investigated. A recipe for the preparation of targets of Rb-acetate on thin carbon backings is given. (auth)

14806 AN ULTRA-THIN-WINDOW GAS CELL. Laumer, H.; Davids, C. N.; Austin, S. M.; Panggabean, L. M. (Michigan State Univ., East Lansing (USA). Cyclotron Lab.). Nucl. Instrum. Methods; 120: No. 3, 535-536(15 Sep 1974).

A gas cell has been developed for which the total areal density encountered by outgoing reaction products can be as low as 50 $\mu g/cm^2$ at 25 torr gas pressure. (auth)

14807 THE PRODUCTION OF A 2-10 MeV COLLIMATED MONOENERGETIC NEUTRON BEAM OF KNOWN FLUX USING THE ASSOCIATED PARTICLE TECHNIQUE. Bartle, C. M.; Quin, P. A. (Wisconsin Univ., Madison (USA). Dept. of Physics). Nucl. Instrum. Methods; 121: No. 1, 119-127(1 Oct 1974).

The associated particle technique is used with neutrons from the $^2H(d,n)^3He$ reaction to provide a monoenergetic neutron beam in the range 2 to 10 MeV. The neutron energy range achieved with this system requires a corresponding range in deuteron energy of 2 to 12 MeV. The collimation of the neutron beam is accomplished electronically. To produce neutron beams with energies in the 2 to 5 MeV range the associated ^3He ions are counted with unambiguous resolution in a solid state detector. Above 5 MeV the ^3He ions are counted with similar accuracy by comparing the yield from the primary deuterated-polyethylene target with the yield from a carbon target of comparable areal density. For a 0.5 μA deuteron beam in the MeV range the flux at the center of the neutron beam produced with a 0.5 μm thick deuterated-polyethylene target is typically 100 s^{-1} msr^{-1}. Neutron cross-sections and nuclear lifetimes are measured using an appropriate scintillator which serves simultaneously both as target and detector. The timing resolution between associated events in the ^3He-ion and neutron detectors is 1 to 2 ns depending on the neutron detector used. (auth)

14808 DEVELOPMENT OF A RELIABLE GAS-JET TRANSPORT SYSTEM FOR USE AT THE OAK RIDGE ISOCHRONOUS CYCLOTRON. Schmidt-Ott, W. D. (UNISOR, Oak Ridge, Tenn. (USA)); Toth, K. S. (Oak Ridge National Lab., Tenn. (USA)). Nucl. Instrum. Methods; 121: No. 1, 97-104(1 Oct 1974).

In a previous paper transport yields of recoil nuclei produced in heavy-ion-induced reactions through capillaries were reported. These studies have now been extended to develop a reliable gas-jet-capillary transport system for use in conjunction with the heavy-ion beams available at the Oak Ridge isochronous cyclotron. Several additives to the helium gas were used and tested for their effectiveness to increase the transport efficiency. With water as the additive and a 10 m teflon capillary, i.d. of 1.3 mm, connecting the reaction and collection chambers an efficiency of ~20% was measured. Under similar conditions an upper limit of ≤ 10 s was determined for the transport time. However, with an annular Si(Au) α-detector it was possible to observe ^{167}W, $T_{\frac{1}{2}} \leq 0.25$ s. Also, the efficiency of the system was found to be remarkably constant; during a 7 h period it varied only by about 10%. Most of the tests and developments were made as part of experiments that had to do with short-lived nuclei. Some of these experiments are described to illustrate the versatility and usefulness of the capillary transport system. (auth)

14809 A SUPERCONDUCTING MAGNET FOR IN-BEAM MAGNETIC MOMENT MEASUREMENTS. Young, L. E.; Brenn, R.; Sprouse, G. D. (State Univ. of New York, Stony Brook (USA). Dept. of Physics). Nucl. Instrum. Methods; 121: No. 1, 87-90 (1 Oct 1974).

A versatile, superconducting, split-pair solenoid with 65 kG field strength has been built for nuclear magnetic moment studies using beams from a tandem Van de Graaff. Typical projectile orbits in the fringe field are shown and collimation and shielding problems are discussed. (auth)

14810 A SIMPLE ^3He CRYOSTAT FOR POLARIZED TARGETS. Herr, H.; Kadansky, V. (Bonn Univ. (F.R. Germany). Physikalisches Inst.). Nucl. Instrum. Methods; 121: No. 1, 1-3 (1 Oct 1974).

A horizontal continuous flow ^4He cryostat, operating with ^3He after a simple modification, achieved a cooling power of 200 mW at 0.5 K. The cryostat used for photoproduction experiments can be cooled from room temperature down to 0.5 K in about 1 hour. (auth)

14811 SCHEME FOR SPREADING SECONDARY BEAMS IN THE ITEP MODIFIED PROTON SYNCHROTRON. Barabash, L. Z.; Vishevskii, M. E.; Gol'din, L. L.; Eliseev, G. P.; Kats, M. M.; Koshkarev, D. G.; Leksin, G. A.; Miller, V. V.; Smirnitskii, V. A.; Sokolovskii, V. V.; Sokolov, L. I.; Shebanov, V. A.; Tsukerman, I. S. (Inst. of Theoretical and Experimental Physics, Moscow). pp 200-201 of Trudy tret'ego Vsesoyuznogo soveshchaniya po uskoritelyam zaryazhennykh chastits. Tom II. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

From 3rd all-union conference on charged particle accelerators; Moscow, USSR (1973).

This study describes the scheme for spreading secondary beams of charged and neutral particles from internal targets of an accelerator after its reconstruction. All beams are constructed according to an "achromatic" or "almost achromatic" scheme with one intermediate image, a field lens and a remote pulse collector. Data are presented on estimating the intensity of secondary beams. (tr-SJR)

PHYSICS (ASTROPHYSICS AND COSMOLOGY)

14812 ANNUAL REVIEW OF ASTRONOMY AND ASTROPHYSICS. Burbidge, G. R. (ed.). Palo Alto, CA; Annual Reviews, Inc. (1974). 502p. $12.00.

Separate abstracts were prepared for 15 of the 17 reviews. (WDM)

For abstracts of individual sections see: 14815, 14834–14838, 14868, 14884–14886, and 14914–14918.

Cosmic Radiation

Refer also to abstract 15059.

14813 GALACTIC X-RAY IONIZATION EFFECTS IN GEOMAGNETIC HORIZONTAL FIELD. Murty, A. V. S.; Yacob, A. (Indian Inst. of Geomagnetism, Bombay). Planet. Space Sci.; 22: No. 11, 1583-1584(Nov 1974).

Examination of the night-time geomagnetic horizontal field component at Alibag for international quiet-days of solar minimum epochs, show effects of galactic x-ray ionization as depressions in the field approximately corresponding to transit times of individual sources. (auth)

14814 VARIABILITY OF THE ^{26}Al PRODUCTION RATE IN ORDINARY CHONDRITES. Herzog, G. F. (Rutgers–The State Univ., New Brunswick, NJ); Cressy, P. J. Jr. Geochim. Cosmochim. Acta; 38: No. 12, 1827-1841(Dec 1974).

Fifteen ordinary chondrites for which unusually high spallogenic Ne^{22}/Ne^{21} or He^3/Ne^{21} ratios had been reported and one meteorite with marked shock characteristics were selected in order to investigate the relations between Ne^{22}/Ne^{21} ratios, Al^{26} contents and depth. Al^{26} and K contents of 13 samples from 11 of these are reported and noble gas contents of 30 samples from all of these stones. A decrease in the Al^{26} production rate accompanies the increase of Ne^{22}/Ne^{21} towards the pre-atmospheric surface: $Al^{26}_{obs}/Al^{26}_{calc}$ = 3.2 to 2.0 Ne^{22}/Ne^{21} for $1.08 \leq Ne^{22}/Ne^{21} \leq 1.2$. Large deviations from this relationship may indicate that a meteorite experienced an abnormal flux of cosmic rays. For $Ne^{22}/Ne^{21} > 1.2$ this trend continues but the data scatter more, probably because of the steadily increasing influence of pre-atmospheric size. Ne^{22}/Ne^{21} ratios increase most rapidly in the outermost few centimeters according both to a plot of Ne^{22}/Ne^{21} vs (recovered mass)$^{\frac{1}{3}}$ and to track studies. The increase seems to derive from the enhanced importance of nuclear reactions on Si. $Ne^{22}/Ne^{21} < 1.08$ defines a region where the Al^{26} production rates are less sensitive to depth and vanish in the limit of large shielding; the weak correlation between Ne^{22}/Ne^{21} and Al^{26} in this region rules out the use of the Ne^{22}/Ne^{21} ratio as a basis for a shielding correction to Al^{26}. (auth)

14815 COSMIC-RAY PROPAGATION IN THE GALAXY: COLLECTIVE EFFECTS. Wentzel, D. G. (Tata Inst. of Fundamental Research, Bombay). Annu. Rev. Astron. Astrophys.; 12: 71-96(1974).

A brief summary is given on the observations of cosmic rays relevant to their scattering and lifetimes in the Galaxy and the consequences of the scattering for galactic gas dynamics are outlined. The physics involved in the scattering by hydromagnetic waves, the generation of these waves by the cosmic rays, and the consequent "self-confinement" of the cosmic rays to the Galaxy is summarized. The limitations, difficulties, and criticisms of the theory are reviewed. A review of the various theories on the scattering and propagation of cosmic rays suggests that some fundamental concept is still missing. The collective effects of cosmic rays on galactic gas dynamics, on the gas raised by cosmic rays above spiral arms, and on the resulting galactic wind are summarized. (WDM)

14816 COSMIC RAY ANISOTROPIES OBSERVED LATE IN THE DECAY PHASE OF SOLAR FLARE EVENTS. Allum, F. R.; Palmeira, R. A. R.; McCracken, K. G.; Rao, U. R. (Texas Univ., Dallas (USA)); Fairfield, D. H. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center); Gleeson, L. J. (California Univ., La Jolla, San Diego (USA)). Solar Phys.; 38: No. 1, 227-256(Sep 1974).

Current interplanetary magnetic field and 0.7 to 7.6 MeV proton cosmic-ray anisotropy data obtained from instrumentation on Explorers 34 and 41 are examined for five cosmic-ray events in which a persistent eastern-anisotropy phase is observed late in the event ($t \gtrsim 4$ days). The direction of the anisotropy at such times shows remarkable invariance with respect to the direction of the magnetic field (which generally varies throughout the event) and it is also independent of particle species (electrons and protons) and particle speed over the range $0.06 \leq \beta \leq 0.56$. The anisotropy is from the direction 38.3° ± 2.4°E of the solar radius vector, and is inferred to be orthogonal to the long term, mean interplanetary field direction. Both the amplitude of the anisotropy and the decay time constant show a strong dependence on the magnetic field azimuth. Detailed comparison of the anisotropy and the magnetic field data shows that the simple model of convection plus diffusion parallel to the magnetic field is applicable for this phase of the flare effect. It is demonstrated that contemporary theories do not predict the invariance of the direction as observed, even when the magnetic field is steady; these theories need extension to take into account the magnetic field direction ψ varying from its mean direction ψ_0. It is shown that the late phase anisotropy vector is not expected to be everywhere perpendicular to the mean magnetic field. The suggestion that kinks in the magnetic field moving radially outwards from the Sun are being observed leads to the conclusion that the parallel diffusion coefficient varies as $1/\cos^2(\psi-\psi_0)$. Density gradients in the late decay phase are estimated to be ~700%/AU for 0.7 to 7.6 MeV protons. A simple theory reproduces the dependence of the decay time constant on anisotropy; it also leads to a radial density gradient of about 1000%/AU and diffusion coefficient of 1.3×10^{20} cm^2 s^{-1}. (auth)

14817 COSMIC-RAY MUON-INDUCED ^{129}I IN TELLURIUM ORES. Takagi, J.; Hampel, W.; Kirsten, T. (Max-Planck-Institut fuer Kernphysik, Heidelberg (F.R. Germany)). Earth Planet. Sci. Lett.; 24: No. 1, 141-150(Nov 1974).

1.7×10^7 yr-lived ^{129}I has been positively detected in two natural tellurium ores by activation analysis with the help of low-level sum-coincidence gamma-ray spectrometry. The observed ^{129}I concentrations can be explained as induced by muon reactions on ^{130}Te. The detection of ^{129}I provides for the first time conclusive evidence for the occurrence of natural long-lived muon-induced nuclides. Most of the ^{129}Xe and ^{131}Xe anomalies observed in natural tellurides are best interpreted in terms of reactions induced by muons and their secondary neutrons. (auth)

14818 TRAPPED SOLAR WIND He, Ne AND Ar AND ENERGETIC He IN SURVEYOR 3. Warasila, R. L.; Schaeffer, O. A. (State Univ. of New York, Stony Brook (USA). Dept. of Earth and Space Sciences). Earth Planet. Sci. Lett.; 24: No. 1, 71-77(Nov 1974).

The Apollo 12 mission brought back sections of the Surveyor 3 vehicle suitable for mass spectrometric studies of implanted solar wind and solar cosmic rays. Using this method, an average solar wind ^{4}He flux of 6.1×10^6 ions/cm^2 sec has been obtained for the 31 months of exposure. The authors also measured ^{4}He/^{3}He = 2700 ± 50; ^{4}He/^{20}Ne = 410 ± 30; ^{20}Ne/^{22}Ne = 13.5 ± 0.2; ^{20}Ne/^{37}Ar = 24.5 ± 2.5; and ^{36}Ar/^{38}Ar = 5.41 ± 0.20. These measurements provide solar wind values averaged over considerably longer periods of time than the Apollo Solar Wind Composition experiments and suggest that the short term SWC measurements during a period of high solar activity may not be a reliable measure of average solar wind composition. (auth)

14819 INFLUENCE OF MULTIPLE COMPTON SCATTERING ON THE SPECTRUM OF SOFT DIFFUSE GAMMA RAYS AT BALLOON ALTITUDES. Moyano, C.; Schoenfelder, V. (Max-Planck-Institut fuer Physik und Astrophysik, Garching; Muenchen (F. R. Germany). Inst. fuer Extraterrestrische Physik). Astrophys. Space Sci.; 30: No. 2, L17-L20(Oct 1974).

A Monte Carlo program has been developed in order to examine the influence of multiple Compton scattering in the atmosphere on the spectrum of cosmic diffuse gamma rays. It is shown that the corrections to be made to the measurements of the double-Compton gamma telescope at 2.5 gr cm^{-2} rest atmosphere by Schonfelder and Lichti (1974) are lower than 4% in the energy range between 1.5 and 10 MeV. (auth)

14820 THE COMPOSITION OF THE COSMIC RADIATION AND THE ATOMIC PROPERTIES OF THE ELEMENTS. Kristiansson, K. (Lund Univ. (Sweden). Fysiska Institutionen). Astrophys. Space Sci.; 30: No. 2, 417-431(Oct 1974).

The composition of the primordial cosmic radiation has been compared with the solar system composition and that of interstellar matter. It is found that the overabundance of an element in the radiation is approximately proportional to the cross section for the ionization of neutral atoms of that element through fast charged-particle impacts. The results strongly support the assumption that the selection of cosmic-ray particles is governed by the atomic properties of the elements. (auth)

14821 THE COMPARATIVE SPECTRA OF COSMIC-RAY PROTONS AND HELIUM NUCLEI. Webber, W. R.; Lezniak, J. A. (New Hampshire Univ., Durham (USA). Dept. of Physics). Astrophys. Space Sci.; 30: No. 2, 361-380(Oct 1974).

The measurements of the primary cosmic-ray proton and helium nuclei intensities have been re-examined and extended in the range from a few MeV nuc^{-1} to ~100 GeV nuc^{-1} using a considerable body of recently published data. The differential spectra obtained from this data are determined as a function of both energy and rigidity. The exponents of the energy spectra of both protons and helium nuclei are found to be different at the same energy/nucleon and to increase with increasing energy between 1 and 100 GeV nuc^{-1} reaching a value = -2.70 at higher energies and in addition, the P/He ratio changes from a value $\lesssim 5$ at 1 GeV nuc^{-1} and below to a value ~30 at 100 GeV nuc^{-1}. On a rigidity representation the spectral exponent for each species is nearly identical and remains virtually constant above several GV at a value of -2.70, and in addition, the P/He ratio is also a constant ~7 above ~3 GeV. The changing P/He ratio and spectral exponent on an energy representation occur at energies well above those at which interplanetary modulation effects or interstellar ionization energy loss effects can significantly affect the spectra. In effect by comparing energy spectra and rigidity spectra in the intermediate energy range above the point where solar modulation effects and interstellar energy loss effects are important, but in the range where there are significant differences between energy and rigidity spectra, we deduce that the cosmic-ray source spectra are effectively rigidity spectra. This fact has important implications regarding the mechanism of acceleration of this radiation and also with regard to the form of the assumed galactic spectrum at low energies. The relationship between the proton and helium spectra derived here and the heavier nuclei spectral differences recently reported in the literature is also examined. If rigidity spectra are adopted for protons and helium nuclei, then the source abundance ratio of these two components is determined to be ~7 : 1. Some cosmological implications of this ratio are discussed. (auth)

14822 RADIOACTIVE ISOTOPES IN THE LITHOSPHERE. Chrapan, J.; Sitar, B. Acta Fac. Rerum Natur. Univ. Comenianae, Phys.; No. 14, 147-157(1973). (In Slovak).

A review is presented on the problems connected with the production of radioactive isotopes in the lithosphere by cosmic radiation and by intrinsic radioactivity of the lithosphere itself. A study is made of the flux density of cosmic-ray particles causing nuclear reactions in the lithosphere, showing that the frequency of nuclear transmutations caused by neutrinos is very low. In discussing the intrinsic radioactivity of the lithosphere, four groups of radioactive isotopes which are the source of this activity are distinguished. Finally, a study is made of the origin and composition of the various layers of target material in the lithosphere. (IAA)

14823 COSMOLOGY WITH THE LST. Sandage, A. (Hale Observatories, Pasadena, CA). pp 19-22 of Large Space Telescope: A New Tool for Science. New York; American Inst. of Aeronautics and Astronautics, Inc. (1974).

From 12th aerospace sciences meeting; Washington, DC (30 Jan 1974).

Current fundamental cosmological problems include: (1) precise mapping of the nearby velocity field of the Hubble expansion by obtaining accurate distances to resolved galaxies—perturbations of this flow caused by the inhomogeneous distribution of nearby galaxies are related to the cosmic deceleration parameter, and hence to the global model; (2) the motion of the Earth relative to the rest frame of the Universe by searching for an anisotropy in the kinematic field of local galaxies—agreement with the isotropy of the 3 K radio field will be fundamental; and (3) two angular diameter tests to determine the dependence of surface brightness on redshift and hence to test directly if the observed redshift phenomenon is due to a real recessional motion. (auth)

Stars

Refer also to abstracts 15031, 15425, 15533, and 15592.

14824 INTERPRETATION OF EMISSION LINE PROFILES FROM ENVELOPES OF Be STARS. I. The Radiation Field. Kriz, S. (Astronomical Inst., Ondrejov, Czech.). Bull. Astron. Inst. Czech.; 25: No. 3, 143-152(1974).

This paper presents a solution of the equation of line radiation transfer for a moving envelope of a Be star. Formulae are derived for the mean intensity of the radiation J and for the emission line profile. Illustrative computations of the line profiles are presented. The possibility of determining the physical conditions of the envelope directly from the observed line profiles is discussed. (IAA) (auth)

14825 PHOTOELECTRIC PHOTOMETRY OF TV CASSIOPEIAE. Papousek, J. (Astronomical Inst., Ondrejov, Czech.). Bull. Astron. Inst. Czech.; 25: No. 3, 152-160(1974).

1583 photoelectric observations in B and V and 1469 in U color were carried out at the Brno Observatory in 1972. Nine new times of primary minimum light, derived on the basis of these observations, are presented. The photoelectric orbital solution is ambiguous, two different solutions exist. The limb darkening coefficient for the primary component was derived from the light curve. (IAA) (auth)

14826 INFRA-RED PHOTOMETRY AND POLARIMETRY OF COLD STARS. Khozov, G. V.; Khudyakova, T. N. Uch. Zap. Tartu. Gos. Univ.; 30: No. 373, 48-68(1974). (In Russian).

The results of the infrared photometric and polarimetric observations of 20 cold stars are presented. The observations were carried out in 1969-1971 in the standard I and K bands with the use of 61.5 cm reflector of the Bjurakan astrophysical station of the Leningrad University. (auth)

14827 SPECTRA OF DIATOMIC MOLECULES. I. Mel'nikov, O. A.; Salman-Zade, R. Kh.; Solonskii, Yu. A.; Khilov, E. D. Uch. Zap. Tartu. Gos. Univ.; 30: No. 373, 192-228(1974). (In Russian).

The questions of the systematics and theory of astrophysical interest two-atom molecular spectra are discussed. (auth)

14828 VARIABLE POLARIZATION OF RADIATION OF HR DEL, Z AND Z CAM. Belokon, E. T.; Shulov, O. S. Uch. Zap. Tartu. Gos. Univ.; 30: No. 373, 103-110(1974). (In Russian).

The polarimetric and photometric observations of HR Del, Z And, and Z Cam are reported. The three stars demonstrate variable polarization. (auth)

14829 POLARIMETRIC AND PHOTOMETRIC INVESTIGATION OF VARIABLE STARS. II. Dombrovskii, V. S.; Polyakova, T. A. Uch. Zap. Tartu. Gos. Univ.; 30: No. 373, 89-103(1974). (In Russian).

The results of polarimetric and photometric observations of μ Cep, V CVn, and RY Tau during 1971 and of AE Cap, R Gem, and VY CMa during several years are given. There are also presented the results of the test observations of the high luminosity red variables: R Agr, RX Boo, RS Cnc, T Cnc, T Cep, o Cet, T Dra, RY Dra, X Her, U Her, T Lyr, α Ori, and Z Psc. The variations of polarization with the change of brightness and wavelength are discussed briefly. (auth)

14830 FINDING LIST FOR FLUORESCING LINES IN STARS WITH STRONG EMISSION LINES OF H, Mg II, AND Ca II. Gahm, G. F. (Stockholm Observatory). Astron. Astrophys., Suppl. Ser.; 18: No. 2, 259-266(Nov 1974).

A catalog of spectral lines which may show anomalous line intensities due to fluorescent processes in stars showing strong emission in the Lyman and Balmer lines of hydrogen and/or in the resonance doublets of Mg II and Ca II is presented. (auth)

14831 EMISSION LINES AND RADIAL VELOCITIES OF THE VV CEPHEI TYPE STAR BD + 54°2698. Barbier, M. (Observatory, Marseille). Astron. Astrophys., Suppl. Ser.; 18: No. 2, 251-257(Nov 1974). (In French).

Four spectrographic plates of BD + 54°2698 have been obtained at a dispersion of 20 Å mm^{-1}. The spectrograms cover the spectral field from 3400 to 5200 Å. More than one hundred emission lines were identified, principally of [FeII] and FeII, but also of [SII], [FeIII], [NiII], [CuII], SiII, SII, TiII, CrII, and NiII. The Balmer lines are visible in emission from Hγ to H14. The radial velocities of the emission lines of the different elements are very similar to the radial velocities of the M star. It seems that these elements are associated with its extended atmosphere. The hydrogen lines in absorption have a radial velocity very different and suggest that BD + 54°2698 is a double system. (auth)

14832 PHOTOMETRIC OBSERVATIONS OF DELTA SCUTI STARS. II. HR 432, HR 515, HR 812. Valtier, J. C.; Sareyan, J. P.; Le Contel, J. M.; Zribi, G. (Observatory, Nice). Astron. Astrophys., Suppl. Ser.; 18: No. 2, 235-249(Nov 1974).

Light curves of the three δ Scuti stars HR 432, HR 515, and HR 812 are presented. For each star a "mean period" (respectively 0.13, 0.2, and 0.06 day) was estimated and temperature variations between 0 °K and 130 °K were deduced. Since these results confirm previous ones, models including nonlinear effects are required to account for these observations. (auth)

14833 PHOTOELECTRIC CATALOG OF 1030 BD M-TYPE STARS LOCATED ALONG THE GALACTIC EQUATOR. Neckel,

H. (Sternwarte, Hamburg). Astron. Astrophys., Suppl. Ser.; 18: No. 2, 169-234(Nov 1974).

The majority of the cataloged stars, all of which are of spectral type M2 or M3, have been observed two or more times. Because all stars are potential candidates for being variable, the magnitudes (V) and colors (B−V) are given for each individual observation. The mean errors are estimated to be about ±0.020m in V and ±0.015m in B−V. 63 stars are known or suspected variables. 128 stars are new variables according to these observations. A crude estimate indicates that about 20 per cent of the M2 stars, and 35 per cent of the M3 stars will show noticeable variations. Some stars with a relatively low color index may be nearby dwarfs; two stars are suspected to be flare stars. (auth)

14834 EQUATION OF STATE AT ULTRAHIGH DENSITIES. I. Canuto, V. (Goddard Space Flight Center, New York). Annu. Rev. Astron. Astronphys.; 12: 167-214(1974).

An attempt is made to present the current status of knowledge about matter at densities in the range $10^6 \leq \rho \leq 5 \times 10^{14}$ gm cm^{-3}. Primary interest is in the physics involved in the construction of an equation of state, which is the fundamental ingredient for deriving parameters like mass, radius, moment of inertia, pulsation properties, etc. Given a reliable equation of state, such parameters can be derived rather straight-forwardly. (WDM)

14835 POST MAIN SEQUENCE EVOLUTION OF SINGLE STARS. Iben, I. Jr. (Univ. of Illinois, Urbana). Annu. Rev. Astron. Astrophys.; 12: 215-256(1974).

Discussion is limited to the evolution of single stars in quasi-static phases, avoiding all discussion of binary systems and of final stellar states. The lingering uncertainties in main-sequence evolution are briefly discussed. Low-mass stars are considered, where an attempt is made to show that most steps between the main-sequence and white dwarfs are understood, at least qualitatively, and that even some modestly quantitative statements may be made about the internal properties of stars in old clusters. Evolution of intermediate-mass stars is discussed, with emphasis on core helium-burning stages and on the interior properties of stars with large carbon−oxygen cores in which electrons are degenerate. Progress in understanding more massive stars is briefly catalogued. (WDM)

14836 CHEMICALLY PECULIAR STARS OF THE UPPER MAIN SEQUENCE. Preston, G. W. (California Inst. of Tech., Pasadena). Annu. Rev. Astron. Astrophys.; 12: 257-277(1974).

During the past few years several hypotheses have been advanced to account for the various chemically-peculiar stars. Those data needed to construct and test explanations for the CP stars are summarized. The λ Bootis and He-rich stars are not considered. (WDM)

14837 SPECTRA OF SUPERNOVAE. Oke, J. B.; Searle, L. (California Inst. of Tech., Pasadena). Annu. Rev. Astron. Astrophys.; 12: 315-329(1974).

Special emphasis is given to one important and neglected aspect of supernova research and the literature concerned with the description, classification, and interpretation of the spectra of supernovae is discussed. (WDM)

14838 PLANETARY NEBULAE. Miller, J. S. (Univ. of California, Santa Cruz). Annu. Rev. Astron. Astrophys.; 12: 331-358(1974).

A discussion is presented on the optical spectra of the nebulae and an understanding of the physical processes involved. The relatively new subjects of infrared and radio studies are considered, and the problems of the ionization and excitation structure of the nebular gas are discussed. A brief account is given of current ideas on the formation of planetary nebulae and the relationship of them to other concerns of astronomy. (WDM)

14839 NONSELF-SIMILAR PROPAGATION OF SHOCK WAVES IN STELLAR SYSTEMS. Mallik, D. D.; Singkh, P.; Debrei, G. (Leningrad State Univ.). Vestn. Leningrad. Univ., Mat., Mekh., Astron.; 125-132(Apr 1974). (In Russian).

The propagation of a spherical shock wave of variable intensity generated by a localized explosion in a self-gravitating gas sphere is analyzed. A dimensional analysis leads to a first-approximation solution of the problem, assuming that the density of the medium is described by a power law. It is shown that for a power-law exponent of 2.5, the problem reduces to self-similar motion. A second-approximation solution is found to hold only for small periods after the explosion. Numerical results are obtained for an exponent of 2.49 and a specific heat ratio of 5/3. (IAA)

14840 THE INSTABILITY OF STRONG MAGNETIC FIELDS IN STELLAR INTERIORS. Parker, E. N. (Chicago Univ., Ill. (USA). Dept. of Physics). Astrophys. Space Sci.; 31: No. 1, 261-266(Nov 1974).

There has been discussion of the possibility of resolving the solar neutrino dilemma with a sufficiently strong magnetic field (5×10^8 G) in the solar interior to relieve the gas pressure by some ten percent or more. The time in which magnetic buoyancy will bring a strong field to the surface is examined and found to be less than 10^8 yr. No possibility is seen for retaining a suitably strong magnetic field in the solar interior. (auth)

14841 SUPERNOVAE IN CLOSE BINARIES. Cheng, A. (Columbia Univ., New York (USA). Dept. of Physics). Astrophys. Space Sci.; 31: No. 1, 49-56(Nov 1974).

The impact of a supernova shell onto 2.82 $M_\odot$ and 20.0 $M_\odot$ main-sequence stars is investigated for various initial orbital separations, and various supernova shell masses and velocities. The inelastic collision between the star and the supernova shell, the shock propagation into the companion star, and other forms of momentum transfer such as the rocket effect are considered. The total momentum transfer due to the supernova is insufficient to eject the companion from the binary as long as the companion retains most of its mass, regardless of the initial orbital separation. Ejection of the companion may occur if the companion is nearly destroyed. Even in contact binaries destruction does not necessarily occur, and if the orbital separation exceeds 10^{12} cm, destruction of the companion becomes quite unlikely. (auth)

14842 ON THERMAL-CONVECTIVE INSTABILITY IN A STELLAR ATMOSPHERE WITH FINITE LARMOR RADIUS AND HALL EFFECTS. Sharma, R. C.; Prakash, K. (Himachal Pradesh Univ., Calcutta (India)). Astrophys. Space Sci.; 31: No. 1, 43-47(Nov 1974).

The thermal-convective instability of a stellar atmosphere is considered to include rotation, finite Larmor radius, and Hall effects in the presence of a uniform vertical magnetic field. The criterion for monotonic instability is found to be the same even if the above effects are included. (auth)

14843 MAIN SEQUENCE MODELS FOR MASSIVE ZERO-METAL STARS. Cary, N. (Virginia Univ., Charlottesville (USA)). Astrophys. Space Sci.; 31: No. 1, 3-10(Nov 1974).

Zero-age main-sequence models for stars of 20, 10, 5, and 2 $M_\odot$ with no heavy elements are constructed for three different possible primordial helium abundances: Y = 0.00, Y = 0.23, and Y = 0.30. The latter two values of Y bracket the range of primordial helium abundances cited by Wagoner. With the exceptions of the two 20 $M_\odot$ models that contain helium, these models are found to be self-consistent in the sense that the formation of carbon through the triple-alpha process during pre-main sequence contraction is not sufficient to bring the CN cycle into competition with the proton−proton chain on the ZAMS. The zero-metal models of the present study have higher surface and central densities, smaller radii, and smaller convective cores than do the population I models with the same masses. If galaxies containing the zero-metal stars were formed as recently as one third the Hubble time, they would likely appear very blue today—perhaps bluer even than most known quasars—and their redshifted effective temperatures could range as high as 3×10^4K to 4×10^4K. (auth)

14844 HYDROGEN AND HELIUM SPECTRA IN LARGE MAGNETIC FIELDS. Garstang, R. H.; Kemic, S. B. (Joint Inst. for Lab. Astrophysics, Boulder, Colo. (USA)). Astrophys. Space Sci.; 31: No. 1, 103-115(Nov 1974).

The energy levels and wave functions of hydrogen and helium atoms in the presence of large (~10^7 G) magnetic fields are found by assuming that the eigenvalues and eigenvectors may be approximated by those of a truncated Hamiltonian matrix. In these atoms, fields of this size produce, in addition to the usual Paschen−Back effect, a quadratic Zeeman effect. This contributes an upward shift to the energy of all levels, which at sufficiently high fields dominates the Paschen−Back splitting. The behavior of a number of eigenvalues and wave functions as a function of magnetic field is presented. The effects of the field on the wavelengths and strengths of the components of Hβ and the helium lines λλ4471, 4026, and 4120 as well as the forbidden λ4025 are examined. In hydrogen the lines are split into components attributed to the now nondegenerate transitions $nlm_l \rightarrow n'l'm_l'$. In helium forbidden lines are excited, which may develop strengths larger than those of the allowed lines. (auth)

14845 CIRCULATION IN ROTATING DEGENERATE OBJECTS. Kippenhahn, R.; Moellenhoff, C. (Goettingen Univ. (F.R. Germany)). Astrophys. Space Sci.; 31: No. 1, 117-141(Nov 1974).

It is shown that due to degeneracy rather high Eddington−Vogt circulation velocities occur in cooling white dwarfs. The conclusion is that in fast rotating white dwarfs angular momentum is redistributed within a time scale short compared to the cooling time of the star. This might be important for the theory of very oblate rotating white dwarfs. It is shown that similar mechanisms work

in the interior of degenerate, rotating cores of evolved stars, where circulations are driven by contraction energy and by neutrino losses. The circulations redistribute the core's matter within time scales shorter than or comparable with the evolution time scale. (auth)

14846 EVOLUTION OF THE SPECTRUM OF NOVA DELPHINI 1967 DURING 1971 AND 1972. Andrillat, Y.; Fehrenbach, C. (Observatoire de Haute Provence, 04 — Saint-Michel-l'Observatoire (France)); Houziaux, L. (Mons Univ. (Belgium)). Astrophys. Space Sci.; 31: No. 1, 169-185(Nov 1974). (In French)

Continued spectroscopic observations of Nova Del 67 during 1971 and 1972 show a general decrease of the nebular and coronal emission with respect to the local continuum. The continuous spectrum exhibits a strong Balmer emission. Equivalent widths of H I, He I, He II, O I, [O I], O II, [O II], O III, [O III], N III, [S II], [A III], [Ne III], [Ne V], [Fe VI], [Fe VII], [Fe X], [Fe XI], [Fe XIV], [Ni XII], and [Ni XV] are listed. Several line profiles are shown, which can be interpreted in terms of a model proposed by Hutchings (1972). Kinematical properties of the nova envelope do not seem to have changed in the 1968–1972 time interval. However, a study of the [O III] (4959 Å) line indicates that the physical conditions in the polar blobs in 1972 (T_e = 10,660 K, $N_e = 5.5 \times 10^5$ cm^{-3}) are different from those prevailing in equatorial rings ($T_e = 9 \times 100$ K, $N_e = 7 \times 10^{-3}$). (auth)

14847 NEUTRINO EMISSION FROM PLASMONS IN STRONG MAGNETIC FIELDS. Chen, H. H.; Ruderman, M. A. (Columbia Univ., New York (USA). Dept. of Physics); Canuto, V. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). Astrophys. Space Sci.; 31: No. 1, 187-191(Nov 1974).

Neutrino pair emission from stellar interiors has improved effects on certain stages of stellar evolution. Canuto et al. had calculated the energy loss rate for these processes, including the plasmon decay in the presence of a very strong magnetic field. They proposed a new longitudinal plasmon mode depending only on magnetic field, which greatly enhances the neutrino energy loss rate at high densities. It is pointed out that the proposed enhanced emission mode is actually part of a transverse mode spectrum with refraction index n in the limit of infinity. A plasmon can decay into neutrino pairs only when $0 \leq n \leq 1$. It is therefore clear that the proposed mode cannot decay. (auth)

14848 EVIDENCE FOR r-PROCESS ELEMENTS IN HR 8911. Galeotti, P. (Consiglio Nazionale delle Ricerche, Turin (Italy). Lab. di Cosmo-Geofisica). Astrophys. Space Sci.; 31: No. 1, 193-201(Nov 1974).

The results of a spectral analysis of some high-dispersion plates of the peculiar star HR 8911 (κ Piscium) are reported, and the observational evidence for some r-only elements in the atmosphere of this object is discussed. Many uranium lines were observed, so that the presence of this element may be considered certain. The presence of uranium and of some elements with mass number around the A ~ 195 peak gives strong evidence for an r-process mechanism which originated the elemental pecularities in this object. The implications about the origin of peculiar stars are discussed on the ground of an explosive origin of the r-process elements observed in this star. Finally, the uncommon element holmium seems very likely to be present in the atmosphere of this peculiar star. (auth)

14849 SIMILARITY SOLUTION FOR UNSTEADY ACCRETION FLOW. II. Sakashita, S.; Yokosawa, M. (Hokkaido Univ., Sapporo (Japan). Dept. of Physics). Astrophys. Space Sci.; 31: No. 1, 251-259(Nov 1974).

Similarity solution for unsteady accretion flow is obtained. The density distribution of the initial state of the gas surrounding the star is given as $Q_0 \propto r^{-\omega}$. The flow patterns are compared with the results of the numerical computation by Zel'dovich et al. (1972), and it is shown that the similarity solution reproduces the results of the numerical computations well. An unsteady accretion model for the nova-like x-ray source is discussed briefly. (auth)

14850 THE $^{12}C(\alpha,\gamma)^{16}O$ REACTION AND STELLAR HELIUM BURNING. Dyer, P.; Barnes, C. A. (California Inst. of Tech., Pasadena (USA)). Nucl. Phys., A; 233: No. 2, 495-520(18 Nov 1974).

The cross section for the reaction $^{12}C(\alpha,\gamma)^{16}O$ has been measured for a range of c.m. energies extending from 1.41 MeV to 2.94 MeV by using ^{12}C targets of high isotopic purity, large NaI(Tl) crystals, and the time-of-flight technique for the suppression of prompt neutron background and time-independent background. Gamma-ray angular distributions were measured at c.m. energies of 2.18, 2.42, 2.56 and 2.83 MeV. By means of theoretical fits, which include the coherent effects of the 1^- states of ^{16}O at 7.12 MeV, 9.60 MeV, and those at higher energies, the electric-dipole portion of the cross section at astrophysically relevant energies has been determined. A three-level R-matrix parametrization of the data yields an S-factor at $E_{c.m.}$ = 0.3 MeV, $S(0.3\ MeV) = 0.14^{+0.14}_{-0.06}$ MeV · b. A "hybrid" R-matrix optical-model parameterization yields $S(0.3\ MeV) = 0.08^{+0.08}_{-0.04}$ MeV · b. This S-factor is of crucial importance in determining the abundances of ^{12}C and ^{16}O at the end of helium burning in stars. (auth)

14851 CIRCUMSTELLAR GRAINS AND THE INTRINSIC POLARIZATION OF STARLIGHT. Forrest, W. J. San Diego, CA; Univ. of California (1974). 357p. University Microfilms Order No. 74-23,966.

Thesis (Ph. D.).

Twenty-four late-type variable stars exhibiting intrinsic variable polarization were monitored over the range 3.5 μ to 11 μ for several cycles. No conclusive evidence for gross changes in the amount of circumstellar grains was found. Thus, circumstellar infrared emission is attributed to the total abundance of grains surrounding the star which does not change by a large amount with time while intrinsic polarization is attributed to more localized scattering and absorption effects or possibly to aligned grains. Spectrophotometry with $\Delta\lambda/\lambda \approx 0.015$ over the 7.5 to 13.5 μ wavelength range of several stars with different chemical composition indicates excess emission characteristic of 3 types of grains: (1) "blackbody" grains, (2) silicate grains, and (3) silicon carbide grains. (WDM)

14852 EXAMINATION OF LIGHT CURVES OF THE SYSTEM RR LYNCIS. Budding, E. (Manchester Univ. (UK)). Astrophys. Space Sci.; 30: No. 2, 433-441(Oct 1974).

The eclipsing binary system RR Lyncis is examined on the basis of six light curves analyzed by means of iterative optimization techniques. An optimal resultant set of geometric elements for the system is obtained. It is established that there is third light in the system although there are model inadequacies, suggestive of intrinsic variability or circumstellar matter. It is proposed that a third star accounts for this third light and plausible distance limits for such an object are considered. (auth)

14853 THERMAL STABILITY OF RED GIANTS. Shimoni, Y.; Rakavy, G. (Hebrew Univ., Jerusalem (Israel). Dept. of Physics). Astrophys. Space Sci.; 30: No. 2, 381-386(Oct 1974).

The thermal stability of stars with a condensed core and an extended convective envelope (red giants) is discussed. It is shown that the thermal stability is determined by the way the opacity of the photosphere depends on density and temperature. In particular, the H^- opacity in red giants photospheres ensures their stability. (auth)

14854 SPECTRAL LINE CHANGES IN RR TELESCOPII, 1961–72. Aller, L. H.; Keyes, C. D. (California Univ., Los Angeles (USA)). Astrophys. Space Sci.; 30: No. 2, 387-394(Oct 1974).

Spectrophotometric measurements of the nova-like variable RR Tel secured at Cerro Tololo in 1972 with a photoelectric spectrum scanner are compared with previously reported photographic measurements and some photoelectric spectrum scans obtained at Mt. Stromlo in 1961. An attempt has been made to use these data to calibrate the photographic measurements which had much higher spectral resolution. This effort is complicated by the change of the spectrum with time; [Fe VII] and [Ne V] seem to be increasing with respect to Hβ, while [Fe VI], [O III], and [Ne III] appear to be weakening. (auth)

14855 ROTATIONAL DISTORTION OF THE STARS OF ARBITRARY STRUCTURE: FOURTH APPROXIMATION. Kopal, Z.; Mahanta, M. K. (Manchester Univ. (UK)). Astrophys. Space Sci.; 30: No. 2, 347-360(Oct 1974).

Clairaut's theory of the rotational distortion of self-gravitating configurations of arbitrary structure, arising from axial rotation with constant angular velocity, previously developed (cf. Kopal, 1973) to quantities of third order in superficial distortion, has now been extended to terms of fourth order. The differential equations governing the form and exterior potential of stars so rotating have been set up by the method followed in the previous paper (Kopal, 1973) together with their boundary conditions; but their applications to practical cases are being postponed for a subsequent investigation. (auth)

14856 ON H-FUNCTIONS OF RADIATIVE TRANSFER. Das Gupta, S. R. (Dept. of Mathematics, University of North Bengal, Darjeeling, West Bengal, India). Astrophys. Space Sci.; 30: No. 2, 327-342(Oct 1974).

Chandrasekhar's H-function H(z) corresponding to the dispersion function $T(z) = |\delta_{rs} - f_{rs}(z)|$, where $[f_{rs}(z)]$ is of rank 1, is obtained in terms of a Cauchy integral whose density function $Q(x,\omega_1, \omega_2, \ldots)$ can be approximated by approximating polynomials (uniformly converging to Q(x)) having their coefficients expressed

as known functions of the parameters ω_r's. A closed form approximation of H(z) to a sufficiently high degree of accuracy is then readily available by term integration. (auth)

14857 ORDER-OF-SCATTERING OF PARTIALLY POLARIZED RADIATION IN INHOMOGENEOUS, ANISOTROPICALLY SCATTERING ATMOSPHERES. II. Reciprocity and Symmetry Relations. Fymat, A. L.; Ueno, S. (California Inst. of Tech., Pasadena (USA)). Astrophys. Space Sci.; 30: No. 2, 251-273(Oct 1974).

Reciprocity and symmetry relationships, representing local invariants for the scattering phase-matrix, are derived for twelve cases of particle assemblies studied by van de Hulst (1957) including situations of scattering in an arbitrary direction, in the near forward and near backward directions. These relations are used to generate corresponding relations representing global invariants for the scattering and transmission matrices of atmospheres consisting of such assemblies. The latter relations are obtained from the matrix integro-differential equations for scattering and transmission; they apply to single scattering, any finite order of scattering, and after an arbitrary cumulation of scattering orders (finite or infinite). The results are summarized for general inhomogeneous atmospheres and for particular inhomogeneous atmospheres that are symmetrical with respect to their central level. The latter case includes homogeneous atmospheres as a special case. The largest set of local relations obtained contains three independent relations (called universal, reversal, exchange) which can further be combined to yield four additional dependent relations. This circumstance happens in three out of the above twelve cases. In the remaining cases fewer relations (both independent and dependent) remain valid. Likewise, a maximal set of three independent global relations is obtained for general inhomogeneous atmospheres; they too can be linearly combined to yield seven other dependent relations. For the symmetrically inhomogeneous atmospheres, three independent and seven dependent additional relations are obtained. On the basis of these tables, it becomes a trivial matter to provide the local and global invariants (both the independent and the dependent relations) for any assembly of particles and atmospheric inhomogeneity. A mixture of Rayleigh–Cabannes scattering by anisotropic molecules or extremely small particles and Mie scattering by large isotropic particles is considered for illustration. Lastly, the group properties of these invariants are studied. (auth)

14858 RECENTLY SYNTHESIZED R-PROCESS NUCLEI: ULTRA-HEAVY COSMIC RAYS AND PECULIAR STARS. Blake, J. B. (Aerospace Corp., Los Angeles, Calif. (USA)); Schramm, D. N. (Texas Univ., Austin (USA). Dept. of Physics). Astrophys. Space Sci.; 30: No. 2, 275-290(Oct 1974).

Recently synthesized ($t \lesssim 10^9$ yr) r-process material has actinide elemental and isotopic abundance characteristics which can be used to distinguish it from ancient r-process material. The time-dependence of relative actinide abundances provides detailed chronometric information. Also it is shown that, if N = 184 is a neutron magic number as predicted by nuclear theory, the resulting r-process production peak at $A \sim 281$ will in turn yield, due to symmetric fission, a broad abundance peak around $A \sim 135$ to 140. The present results can be used to help verify or refute some current hypotheses concerning the origin of UH cosmic rays and some of the abundance anomalies in peculiar stars. (auth)

14859 STUDY OF THE AX MON SYSTEM. Peton, A. (Observatoire de Haute Provence, 04–Saint-Michel-l'Observatoire (France)). Astrophys. Space Sci.; 30: No. 2, 481-522(Oct 1974). (In French).

This investigation is divided into four main parts. In the first part, the ways in which the envelope affects the composition and the spectral variations, and the orbital motion acts on the envelope absorption intensities and how the extent of the envelope constantly decreases during the 11 yr of the observations are studied. This phenomenon regarding AX Mon has not been previously reported in the literature. However, it explains the appearance of the α Cygni spectrum which occurs according to an arbitrary integral multiple of the orbital periods. Two absorbing envelopes seem to exist: an exterior shell of hydrogen and an interior metallic shell, which appears only when the last hydrogen line of the Balmer series of the envelope is H 27. In the second part, the study of the line Fe II λ 4233 shows the influence of the orbital motion on the profile and, in particular, its effect on the absorption in the envelope. The decrease of the extent of the envelope is shown by means of a series of "isophase curves," which indicates that there is maximum emission whenever there is maximum envelope extension. In the third part, the photometric variations are studied referring to three time-scales: (a) very short time-scale variations (<4 hr). These variations can be important, reaching 0.1 mag, and can be described by a model matter ejection in very hot gaseous streams. (b) Short time-scale variations (>1 day). These variations are connected with the intensity of the satellite absorptions of the line Fe II λ 4233 and could be interpreted as absorption variations in the low layers of the envelope. (c) long-time-scale variations (<3 yr). A perceptible decrease of the amplitude of (b) type variations is observed but no change in their mean value. The AX Mon indices (V = 6.77; B-V = +0.33; U-B = −0.66) can be determined. The amplitude of the variations seems to increase as the envelope increases. In the fourth part, it is shown that the spectral type of the hotter star can be estimated to be B0.5 V and for the cold star to be K2 II. (auth)

14860 ON THE CONSTRUCTION OF MODEL STELLAR ATMOSPHERES. Napier, W. M.; Dodd, R. J. (Royal Observatory, Edinburgh (UK)). Astrophys. Space Sci.; 30: No. 2, 291-298(Oct 1974).

The construction of model atmospheres by means of differential corrections is discussed. Either flux or flux gradients may be minimized, with arbitrary weighting with depth. For the simple atmospheres studied, no convergence problems were encountered even when very poor first approximations were used; and flux constancy in the radiative case was generally attained in three or four iterations. Quantities computed in one iteration may be reused, not only in subsequent iterations within the model, but also in the construction or other models with different T_{eff} or g; and so the method is particularly suited for grid computations. (auth)

14861 ON THE STATIONARY MASS OUTFLOW FROM STARS. Part 1. The Computational Method and the Results for a One-Solar-Mass Star. Zytkow, A. (Polska Akademia Nauk, Warsaw. Zaklad Astronomii). Acta Astron.; 22: 103-139(1972).

Solutions for spherically symmetric, time-independent (stationary) models of outflowing stellar envelopes with radiation pressure in continuum as the main driving force were investigated. The equations of conservation of mass, momentum and energy together with the radiative energy transport equation were integrated for the I solar mass star with luminosity at the surface $L < L_{crit} = 3.88 \times 10^4 L_\odot$. Improved opacity values and the equation of state including the effects of H and He ionization and H_2 dissociation were used. The calculations show that one formally can construct in the yellow supergiant region time-independent models leading to expansion velocities (0-160 km/s) covering well the observed range of velocities for planetary nebulae. Such models are, however, not physically selfconsistent since the basic assumption of time–independence of the flow is in a direct conflict with the relevant time scales: the time scale of the ejection of the whole envelope is of the same order of magnitude as the time scale needed to accelerate an element of gas to the escape velocity. (auth)

14862 EVOLUTION OF SINGLE STARS. Part 7. Evolution of Massive Stars. Ziolkowski, J. (Polska Akademia Nauk, Warsaw. Zaklad Astronomii). Acta Astron.; 22: 327-374(1972).

Evolution of 15 and 30 $M_\odot$ stars up to central carbon ignition and of a 60 $M_\odot$ star up to central helium exhaustion is followed using density criterion for convective instability. It was found that the stars spend the first half of their core helium burning stage in red and the second in blue supergiants region performing extended loops on the H-R diagram. The star starts the loop always where hydrogen burning shell approaches the jump of chemical composition produced earlier by external convective zone. The large extension of blue supergiants region over the spectral types observed in h and χ Per and the Magellanic Clouds seems to indicate that the alternative evolutionary scheme using the temperature criterion provides better agreement with observations than our scheme. This conclusion is, however, not definitive. It is suggested that the investigation of period changes of long period cepheids in Magellanic Clouds could provide a good test. (auth)

14863 EVOLUTION OF CLOSE BINARIES. Part 8. Mass Exchange on the Dynamical Time Scale. Paczynski, B.; Sienkiewicz, R. (Polska Akademia Nauk, Warsaw. Zaklad Astronomii). Acta Astron.; 22: 73-91(1972).

The process of mass exchange in a close binary system is studied in the case where the more massive component has a deep convective envelope while filling up its Roche lobe. It is shown that a considerable fraction of mass is transferred on a dynamical time scale, provided the surface boundary condition for the mass losing component (i.e., the mixing length in its convective envelope) is not affected by the mass loss. However, if the mixing length is increased by the mass outflow, the latter may be strongly suppressed. Following Jędrzejec (1969) the relation is derived between the rate of mass transfer in a close binary and the extent to which the mass losing component overflows its Roche lobe. This relation was used in the evolutionary computations presented. (auth)

14864 MICROTURBULENCE IN ATMOSPHERES OF F, G, K, TYPE STARS. Part 1. Curve of Growth Analysis of G, K, Type Subgiants. Glebocki, R. (Gdansk Univ. (Poland). Instytut Fizyki). Acta Astron.; 22: 141-154(1972).

Analysis of variation of microturbulent velocities on H–R diagram for stars with effective temperatures lower than about 7200°K has been undertaken. In order to remove lack of information about the microturbulence for G, K type subgiants, differential curve of growth analysis is made for 24 G, K stars of luminosity classes III, III-IV and IV. Values of the microturbulence parameter, ξ, and (Fe/H) are obtained. Despite the moderate dispersion of spectrograms accuracy of determination of ξ is fully satisfactory (mean error smaller than 0.3 km/s). The results shown in Table 3 indicate that the microturbulence in subgiants is markedly smaller than in giants. Mean value of ξ for 12 subgiants is equal to 1.12 km/s; the velocity even smaller than generally adopted value for the Sun. (auth)

14865 LST LOOKS AT STELLAR DEATH. Bahcall, J. N. (Inst. for Advanced Study, Princeton, NJ). pp 41-45 of Large Space Telescope: A New Tool for Science. New York; American Inst. of Aeronautics and Astronautics, Inc. (1974).

From 12th aerospace sciences meeting; Washington, DC (30 Jan 1974).

Programs are discussed for studying with the aid of a large space telescope (LST) compact objects which represent the final stages of stellar evolution. These objects include white dwarfs, neutron stars, and black holes. It is assumed that the first generation equipment for the LST will include a photometer, a spectrograph, a wide-field camera, and an infrared detector. The studies suggested would provide, among other things, data to compare the black-hole hypothesis with alternative explanations in a variety of cases. (IAA)

Quasi-Stellar, Radio, and X-Ray Sources

Refer also to abstract 14913.

14866 (AD–783776) SIMULATION OF REDSHIFTS IN HYDROGEN BY PERTURBATIONS. Meyer, J. R. (Naval Postgraduate School, Monterey, Calif. (USA)). Jun 1974. 33p. NTIS $4.75.

Thesis.

The problem of explaining the redshifts in the spectra of quasistellar objects is considered by using first-order quantum perturbation theory to examine classes of perturbing hamiltonians to determine if they could cause a redshift in the spectrum of hydrogen. A method is developed for deriving necessary conditions that a perturbation must satisfy to yield a redshift and conclusions are given for several types of perturbations. (GRA)

14867 PHOTOGRAPHIC PHOTOMETRY OF COMPACT EXTRAGALACTIC OBJECTS. Babadzhanyants, M. K.; Vinokurov, S. K.; Gagen-Torn, V. A.; Semenova, E. V. Uch. Zap. Tartu. Gos. Univ.; 30: No. 373, 69-89(1974). (In Russian).

The results of the photographic observations of six compact extragalactic objects made in 1971 are given. For three of them (3C 345, 3C 371, and 3C 390.3) the detailed UBV light-curves are obtained. The unusual brightness of the quasar 3C 345 is noted. There are indications that in several cases the brightness has measurable changes within one night. The colors change only slightly. (auth)

14868 COMPACT X-RAY SOURCES. Blumenthal, G. R. (Univ. of California, Santa Cruz); Tucker, W. H. Annu. Rev. Astron. Astrophys.; 12: 23-46(1974).

An attempt is made to outline the progress and direction of current research in the field of compact x-ray sources. The general properties of x-ray stars as revealed by the observations are described and mass transfer binary models are discussed. The interpretation of the observations of certain well-studied x-ray stars is treated. (WDM)

14869 A SIMPLE SHOCK WAVE MODEL OF SUPERNOVA REMNANT IC443. Gulliford, P. (Manchester Univ. (UK)). Astrophys. Space Sci.; 31: No. 1, 241-249(Nov 1974).

This paper contains a model of supernova remnant IC 443 and the interstellar gas surrounding it. The basis of this model is the analysis of the motion of nonspherical adiabatic shock waves due to Kompaneets (1960). Observations of adjacent H I and H II regions have been used by several authors to determine the density of gas in the neighborhood of IC 443. The model gives for the explosion energy and age of IC 443, 1.8×10^{50} erg and 13,000 yr, respectively. The expansion velocity of IC 443 using the present model is in reasonable agreement with observations of the remnant. (auth)

14870 ON THE EFFECT OF THE DISTRIBUTION FUNCTION OF THE INJECTED OR FORMED RELATIVISTIC PARTICLES ON THE FREQUENCY SPECTRA OF THE RADIO SOURCES. Braude, S. Ya. (AN Ukrainskoj SSR, Kharkov. Inst. Radiofiziki i Ehlektroniki). Astrophys. Space Sci.; 31: No. 1, 203-207(Nov 1974).

A model of the cosmic radio source with plasma, relativistic electrons, and chaotic magnetic fields is considered. It is assumed that the energy changes of relativistic electrons which are due to spontaneous scattering on the transverse and Langmuir plasmons take place in this radio source. For such a radio source the kinetic equation has been solved in the presence of the injected or formed secondary electrons and the frequency spectrum has been obtained. (auth)

14871 QUASAR ABSORPTION LINES AND SITES OF ABSORBING MEDIA. Krieger, C. J. Astrophys. Space Sci.; 30: No. 2, 443-446(Oct 1974).

A method for the determination of distances of quasars and sites of absorbing media is presented. It is illustrated by application to 3C 191 and PKS 0237-23. The results are compared with those obtained from the traditional Hubble Law. (auth)

14872 ON THE INITIAL ENERGY OF SUPERNOVA REMNANTS. Cavallo, G.; Messina, A. (Consiglio Nazionale delle Ricerche, Bologna (Italy)). Astrophys. Space Sci.; 30: No. 2, 409-416(Oct 1974).

An examination of the histogram of the supernova remnants radii allows one to deduce: (1) some support for the existence of a fairly dense galactic halo at least up to a few kpc from the galactic plane; (2) a first approximation for the initial energy distribution. Although the precise shape is still in doubt and various possibilities exist, one can conclude that the supernova rate should be no less than 1/150 SN yr^{-1}, and no more than 1/70 SN yr^{-1}; the average initial energy should be larger than 1.4×10^{49} erg. (auth)

14873 THE DISTANCE OF BL LAC. Evans, A. (Keele Univ. (UK)). Astrophys. Space Sci.; 30: No. 2, 299-308(Oct 1974).

An upper limit on the distance of BL Lac is derived assuming that (a) the optical continuum is synchrotron radiation produced by relativistic electrons; (b) the magnetic field has the value appropriate for equipartition of energy; (c) the optical object lies within the radio component. The upper limit obtained depends on the mechanism of electron production. Limits are also obtained on the magnetic field and mass of BL Lac, and the possibility that it may be a galaxy in the process of formation is explored. (auth)

14874 OBSERVING QUASARS WITH THE LST. Burbidge, E. M. (Univ. of California, San Diego, La Jolla). pp 29-32 of Large Space Telescope: A New Tool for Science. New York; American Inst. of Aeronautics and Astronautics, Inc. (1974).

From 12th aerospace sciences meeting; Washington, DC (30 Jan 1974).

The quasi-stellar objects are still a mystery as far as their energy source and physical nature are concerned. An understanding of them might throw light on basic problems such as the behavior and interaction of matter and radiation in very strong gravitational fields, and the cosmogony of galaxies. The LST will open up exciting new ways to study QSOs, e.g., observation of the uv in the crucial region 912 to 1550 A in QSOs with small redshifts. Searches for and studies of QSOs fainter than 20 magnitude and the removal of observational limits that restrict complete samples may help us to understand the nature of the redshifts. (auth)

Solar Phenomena

Refer also to abstracts 14816, 14840, 14925, and 14939.

14875 (AD–767215) REVIEW OF NEUTRAL LINE ANALYSIS TECHNIQUES. (Weather Squadron (12th), Ent AFB, Colo. (USA)). 1 Jun 1973. 12p. NTIS $2.75.

There are five basic Hα structures that can be used for inferring neutral lines: filaments, filaments channels, arch filaments, plage corridors, and fibrils. They may be used singularly or in a combined form. This review briefly describes each of these five structures. Procedures (McIntosh) for inferring neutral lines are also discussed. (auth)

14876 (COM–73-50681-341-1) SOLAR-GEOPHYSICAL DATA NUMBER 341, JANUARY 1973. Part I (Prompt Reports). Data for December 1972, November 1972. (National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo. (USA)).

Jan 1973. 109p. (SGD-341-PT-1). National Climatic Center, Asheville, N. C. 28801 $1.25.

Prompt reports are given on data for December 1972 and November 1972. These deal with alert periods, daily solar indices, solar flares, solar radio waves, and spacecraft observations. (GRA)

14877 (COM-73-50681-341-2) SOLAR-GEOPHYSICAL DATA NUMBER 341, JANUARY 1973. Part II (Comprehensive Reports). Data for July 1972, June 1972, and Miscellanea. (National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo. (USA)). Jan 1973. 80p. (SGD-341-PT-2). National Clamatic Center, Asheville, N. C. 28801 $1.25.

Comprehensive data for July 1972 and June 1972 on solar flares, solar radio waves, solar x-ray radiation, and solar proton monitoring is given. Miscellaneous data on solar x-ray radiation for May and June 1972 is included. (GRA)

14878 (COM-73-50681-342-1) SOLAR-GEOPHYSICAL DATA NUMBER 342, February 1973. Part I (Prompt Reports). Data for January 1973, December 1972. (National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo. (USA)). Feb 1973. 114p. (SGD-342-PT-1). National Climatic Center, Asheville, N. C. 28801 $1.25.

Prompt reports are given on data for January 1973 and December 1972. These deal with alert periods, daily solar indices, solar flares, solar radio waves, and spacecraft observations. (GRA)

14879 (COM-73-50681-342-2) SOLAR-GEOPHYSICAL DATA NUMBER 342, February 1973. Part II (Comprehensive Reports). Data for August 1972, July 1972, and Miscellanea. Leighton, H. I. (National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo. (USA)). Feb 1973. 112p. (SGD-342-PT-2). National Climatic Center, Asheville, N. C. 28801 $1.25.

The issue provides comprehensive data for August 1972 and July 1972 on solar flares, solar radio waves, solar x-ray radiation, and solar proton monitoring. It also has miscellaneous data on retrospective world interval, x-ray maps, and neutron monitors for February-May 1972. (GRA)

14880 (COM-74-50190-357-1) SOLAR-GEOPHYSICAL DATA NUMBER 357, MAY 1974. Part I (Prompt Reports). Data for April 1974, March 1974. Leighton, H. I. (National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo. (USA)). May 1974. 115p. (SGD-357-PT-1). National Climatic Center, Asheville, N. C. 28801 $1.25.

Prompt reports are given on data for April 1974 and March 1974. These deal with alert periods, daily solar indices, solar flares, solar radio waves, and spacecraft observations. This issue also includes an index for 1973 and 1974. (GRA)

14881 (COM-74-50190-357-2) SOLAR-GEOPHYSICAL DATA NUMBER 357, MAY 1974. Part II (Comprehensive Reports). Data for November 1973, October 1973, and Miscellanea. Leighton, H. I. (National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo. (USA)). May 1974. 52p. (SGD-357-PT-2). National Climatic Center, Asheville, N. C. 28801 $1.25.

This issue provides comprehensive data for November 1973 and October 1973 on solar flares, solar radio waves, solar x-ray radiation, regional flare index, and cosmic-ray indices. (GRA)

14882 LARGE SUNSPOT GROUPS IN THE YEARS 1955-1964. Kopecky, M.; Kotrc, P. (Astronomical Inst., Ondrejov, Czech.). Bull. Astron. Inst. Czech.; 25: No. 3, 171-180(1974).

On the basis of Greenwich observational data, a catalog of large sunspot groups with an average area of more than 500 millionth, observed in the years 1955-1964, has been compiled and compared with a similar catalogue of Gnevysheva, compiled from Pulkovo sunspot catalogs. The time pattern of the occurrence of large sunspot groups in the 19th cycle of solar activity is discussed. It is pointed out that the occurrence of large sunspot groups is evidence that an outburst of solar activity in certain time intervals takes place simultaneously over most of the solar surface, probably regardless of hemispheres. (IAA) (auth)

14883 INFLUENCE OF THE TEMPERATURE DISTRIBUTION IN THE CHROMOSPHERE ON THE SPECTRUM OF s-COMPONENT OF SOLAR RADIO EMISSION. Fasakhova, M. N.; Yudin, O. I. (Scientific-Research Radiophysics Inst., Gorky, USSR). Izv. Vyssh. Ucheb. Zaved., Radiofiz.; 17: No. 8, 1240-1242(1974). (In Russian).

It has been shown on the basis of abundant experimental material that in the period of development and rearrangement of local sources, spectra of a complex form with several maxima were detected. Within the framework of the magnetobremsstrahlung and bremsstrahlung of the thermal electrons in the active region of the solar chromosphere, these characteristics are explained by changes in the gradient pattern of the kinetic temperature of the electrons with altitude. The conditions under which this could occur were evaluated and it is shown that this explanation is insufficient to explain the phenomena observed. (JSR)

14884 SOLAR ROTATION. Gilman, P. A. (National Center for Atmospheric Research, Boulder, CO). Annu. Rev. Astron. Astrophys.; 12: 47-70(1974).

Topics covered include the importance of solar rotation, the nature of solar rotation, explanations of solar rotation, and direction of future research. (WDM)

14885 SOLAR X-RAY SPECTRUM. Culhane, J. L. (University Coll., London); Acton, L. W. Annu. Rev. Astron. Astrophys.; 12: 359-381(1974).

The structure of the solar corona, the spatial distribution of its x-ray emission, and the observed features of both active region and flare x-ray spectra are discussed. The techniques used for the x-ray observations are outlined. The x-ray emission processes are detailed and the methods employed to obtain physical information from the observed x-ray spectra are described. (WDM)

14886 WAVES IN THE SOLAR ATMOSPHERE. Stein, R. F. (Brandeis Univ., Waltham, MA); Leibacher, J. Annu. Rev. Astron. Astrophys.; 12: 407-435(1974).

As a framework for a discussion of wave motions in the solar atmosphere, the oscillatory modes that can occur are first described. These wave properties are then used to review observations of wave motions in the solar atmosphere and models of the "five-minute" oscillations. A discussion is given on how these waves may be generated and the role they play in heating the chromosphere and corona. (WDM)

14887 COSMIC RAY INTENSITY VARIATIONS IN ANTARCTICA. Pomerantz, M. A.; Duggal, S. P. (Franklin Inst., Swarthmore, PA). Antarct. J. U. S.; 9: No. 5, 204-206(1974).

From an analysis of the Antarctic cosmic-ray observations and the global geomagnetic data, a new mechanism was discovered whereby solar particles are accelerated to cosmic-ray energies in interplanetary space. This occurs when ambient lower-energy particles are trapped between two converging interplanetary shocks. If the trailing shock is moving faster than the leading shock, energy is gained in multiple reflections. (WDM)

14888 SOLAR RADIO FLUX MEASUREMENTS ON WAVELENGTHS OF 37 cm, 56 cm, AND 115 cm. Tlamicha, A.; Kepka, O. (Astronomicky Ustav, Ondrejoy, Czechoslovakia). Bull. Astron. Inst. Czech.; 25: No. 3, 160-162(1974).

14889 HYDROMAGNETIC EMISSION OF THE INTERPLANETARY PLASMA. Gul'elmi, A. V.; Dovbnya, B. V. (Brook Observatory, Institute of the Physics of the Earth, U. S. S. R. Academy of Sciences, Yaroslav, U. S. S. R.). Astrophys. Space Sci.; 31: No. 1, 21-29(Nov 1974).

A new type of geomagnetic pulsation—the "serpentine emission"—has been discovered in the 0 to 2 Hz range. The particular feature which characterizes the serpentine emission is the wide modulation of the carrier frequency. A theory to account for this type of disturbance involves radiation from the solar wind. The frequency modulation is explained in terms of Doppler shifts and variation of the direction of the interplanetary magnetic field. (auth)

14890 AN INVESTIGATION OF SOME LARGE DIRECTIONAL DISCONTINUITIES IN THE SOLAR WIND PLASMA USING MULTISATELLITE OBSERVATIONS. Webb, S.; Quenby, J. J. (Imperial Coll. of Science and Technology, London (UK). Dept. of Physics). Solar Phys.; 38: No. 1, 257-269(Sep 1974).

Eleven large directional discontinuities in the solar wind, simultaneously observed by Explorers 33, 35, and Heos 1 in the period Dec. 1968 to Jan. 1969, have been studied by the triangulation method. Testing the discontinuity normals deduced from the wind speed and timing parameters against those given by the magnetometer observations on different models suggests that 8 were tangential, 2 were rotational while 1 could not be identified. 3 small tangential discontinuities arriving within a period ~35 min were also studied and as a result it is suggested that the solar wind remained stratified in separation planes over a distance ~0.01 AU during that time. The implication of these results is briefly discussed. (auth)

14891 STRUCTURES IN A NON-MAGNETIC SOLAR CORONA. Cross, M. A.; Blockwood, J. V. (Grambling Coll., La. (USA)). Solar Phys.; 38: No. 1, 157-164(Sep 1974).

A fluid mechanical convective instability is examined under the conditions found in the solar corona. Linearized density perturbations are shown to grow as they are carried outward

by the solar wind. The nonlinear instability may be proposed as a cause of coronal structures in nonmagnetic stars, or in regions of the solar corona with weak magnetic fields. (auth)

14892 THE FINE STRUCTURE OF THE SOLAR ATMOSPHERE IN THE FAR ULTRAVIOLET. Brueckner, G. E.; Bartoe, J. F. (Naval Research Lab., Washington, D. C. (USA)). Solar Phys.; 38: No. 1, 133-156(Sep 1974).

High-resolution spectroheliograms in the ultraviolet emission lines He I, He II, O IV, O V, and Ne VII have been photographed during a sounding rocket flight. Simultaneously, broad-band filtergrams of the far ultraviolet solar corona were obtained from the same flight. This paper describes qualitatively the spatial distribution of the uv emission. A comparison with an Hα filtergram is made. The most significant results can be summarized as follows: Most of the ultraviolet emission concentrated around spicules, with different degree of concentration, are found to decrease with higher temperatures. 4 different areas of ultraviolet emission can be distinguished. (1) The normal network, bright in all uv emission lines from the chromosphere into the corona. (2) The coronal holes, bright in all uv emission lines up to 600,000 K but depressed in coronal lines from 1 million degrees upward. (3) The coronal depressions near active centers, absence of all ultraviolet emissions and (4) active regions, where ultraviolet emission comes from plages, sunspots and coronal loops. High nonthermal Doppler velocities can be found in certain plage kernels around 10^5 to 2×10^5K. Sunspots are bright in the ultraviolet, but do not exhibit He I or He II emission. The corona above sunspots is weak. Sunspots do not show high nonthermal Doppler velocities. The He I and He II emission does not follow either chromospheric, transition zone or coronal pattern; one can recognize some typical behavior of each. (auth)

14893 NUMERICAL CALCULATION OF THOMSON SCATTERING FROM INHOMOGENEOUS MODELS OF THE CORONA AND APPLICATION TO STREAMERS OF THE 1970 AND 1972 ECLIPSES. Bohlin, J. D.; Garrison, L. M. (Naval Research Lab., Washington, D. C. (USA)). Solar Phys.; 38: No. 1, 165-179(Sep 1974).

A general computer program has been developed to numerically integrate the Thomson scattered light from arbitrary inhomogeneous models of the solar corona. Conversion from the observer's to solar coordinates is totally general to eliminate restrictions on the lines-of-sight that may be investigated. The tangential and radial components (K_t and K_r), or any combination thereof, are calculated. Four separate output modes are available, corresponding to the common formats used for coronal brightness and polarization data. This program was used to investigate the major NW streamer of the 1972 eclipse. The bifurcated profile of this feature is reproduced by the projection effect of a radially expanding blade, or fan, whose longitudinal axis is twisted to follow an underlying magnetic neutral line on the solar surface. Thus a purely geometrical effect accounts for the observed intensity profile. Published brightness data for the NE streamer of the 1970 eclipse are also reinterpreted using the radially-expanding fan model. The axial density gradients of 1970 and 1972 features are found to be virtually identical from 3 to 8 $R_\odot$. (auth)

14894 CORONAL TEMPERATURES FROM "FROZEN-IN" SOLAR WIND IONS AND OPTICAL LINE PROFILES. Billings, D. E. (Colorado Univ., Boulder (USA). Dept. of Astro-Geophysics). Solar Phys.; 38: No. 1, 181-182(Sep 1974).

A quadratic fit to the temperatures and the temperature gradients of the quiet corona at 1.5 and 3 $R_\odot$ is given. This yields results in close agreement with experiment. (NL)

14895 OBSERVATIONS OF VERY SMALL SOFT X-RAY FLARES. Glencross, W. M.; Dorling, E. B.; Herring, J. R. H. (University Coll., London (UK). Mullard Space Science Lab.). Solar Phys.; 38: No. 1, 183-192(Sep 1974).

Data obtained from a proportional counter on OSO-5 are examined to study variations in emission from individual solar active regions within the waveband 0.3 to 0.9 nm. Flux levels are highly variable, even from the areas having a low mean emission, because increases characteristic of x-ray flares occur most of the time. It is usual to assume that the coronal levels above a plage region are heated by a fairly continuous incident energy flux (perhaps waves), while impulsive effects associated with flares add to this over localized areas. The data given here indicate that the impulsive mechanism is probably the more important in producing the total soft x-ray flux from an active region. There is also reason to believe that many of the small flares observed are not restricted to particularly localized areas. They are of the gradual rise and fall variety which probably have an extended spatial structure. It seems possible that flare heating might account for almost the entire x-ray emission throughout the active region. (auth)

14896 PRELIMINARY RESULTS OF SUN OBSERVATIONS AT 8.6 mm WITH THE BORDEAUX INTERFEROMETER. Bocchia, R.; Poumeyrol, F. (Observatoire de Bordeaux, 33 - Floirac (France)). Solar Phys.; 38: No. 1, 193-203(Sep 1974).

A two antenna interferometer working at 8.6 mm wavelength especially designed for solar studies, is now in operation at the Observatory of Bordeaux University. Preliminary results, deduced from a series of about 60 days of observation, are given. These results are concerned with the terrestrial atmospheric transparency, and the structures of the emissive sources in the chromosphere–corona transition layer where the millimetre waves originate. (auth)

14897 ON THE PROPAGATION OF THE ELECTRON STREAMS GENERATING TYPE III BURSTS. Melrose, D. B. (Commonwealth Scientific and Industrial Research Organization, Epping (Australia). Div. of Radiophysics). Solar Phys.; 38: No. 1, 205-215(Sep 1974).

The suggestion is explored that the two-stream instability has little effect on the propagation of the electron streams which generate type III bursts because the time required (t_i) for development of the instability is comparable with or greater than the time available (Δt) for growth of the waves. Inferred parameters for streams in the corona and measured parameters for streams at the orbit of the Earth are compatible with this suggestion. Quasi-linear relaxation, which should occur as the stream forms, ensures that equality $t_i = \Delta t$ is set up initially, and restricts the number of escaping electrons to $N_s \sim 10^{31}$. The minimum density requirement on the stream for the two-stream instability to occur is found to be much less restrictive than the requirement that there should be many streaming electrons per Debye sphere. (auth)

14898 COMPARISON OF POLARIZATION CHARACTERISTICS OF DECAMETRIC TYPE III SOLAR RADIO BURSTS AT TWO CLOSELY SPACED FREQUENCIES. Mattoo, S. K.; Bhonsle, R. V. (Physical Research Lab., Ahmedabad (India)). Solar Phys.; 38: No. 1, 217-222(Sep 1974).

The paper describes the polarization characteristics of decametric type III solar radio bursts at two closely spaced frequencies, 34.993 and 34.997 MHz. From the simultaneous orientation angle measurements at these two frequencies, it is concluded that the total Faraday rotation suffered by type III bursts could be of the order of 10^3 rad. Polarization characteristics of a few bursts displaying fine structure (4 kHz) in frequency similar to type IIIb bursts have also been described. (auth)

14899 THE REPRESENTATION OF PARTIALLY ELLIPTICALLY POLARIZED TYPE III SOLAR BURST RADIATION. Mattoo, S. K.; Bhonsle, R. V. (Physical Research Lab., Ahmedabad (India)). Solar Phys.; 38: No. 1, 223-226(Sep 1974).

Before Fokker's suggestion (Solar Phys. 19, 472, 1971) regarding the representation of elliptically polarized radiation as a mixture of linear and circular polarization can be tested, it is necessary to correct the observed degree of polarization for the depolarization due to the Faraday dispersion within the receiver bandwidth. It is proposed to do this using the polarization data of type III bursts at 35 MHz, since these bursts generally exhibit partial elliptical polarization. (NL)

14900 IS MAGNETIC CONVECTION IMPORTANT IN THE SUN? Mullan, D. J. (Bartol Research Foundation, Swarthmore, Pa. (USA)). Solar Phys.; 38: No. 1, 9-13(Sep 1974).

Although magnetic convection in all probability does operate inside the Sun, the energy flux which it can carry is 5 to 6 orders of magnitude smaller than the total solar flux. Thus the effects of magnetic convection on the internal temperature structure of the Sun are probably small. (auth)

14901 COMPUTATION OF OSCILLATOR STRENGTHS BY A SEMI-EMPIRICAL METHOD FOR SOME ELEMENTS OF THE IRON-GROUP AND THEIR SOLAR PHOTOSPHERIC ABUNDANCE. I. Results for Ti I. Biemont, E. (Liege Univ. (Belgium). Inst. d'Astrophysique). Solar Phys.; 38: No. 1, 15-31(Sep 1974).

Oscillator strengths are calculated for 259 lines of Ti I by taking configuration interaction into account in a somewhat simplified treatment. Radial integrals are obtained by an adaptation of the scaled Thomas–Fermi method. The great majority of selected lines originate from slightly perturbed terms. From a satisfactory comparison of the gf-values with recent experimental data and with solar results in the visible region, it has been possible to extend the work for some infrared lines. Very few transition probabilities were known for Ti I in that spectral range. On the basis of the oscillator strengths, a mean value $\log N_{Ti} = 4.88 \pm 0.12$ (in the usual scale), is proposed for the solar photospheric abundance, in agreement with the meteoritic value. (auth)

14902 CONVECTIVE FLUX IN THE SOLAR PHOTOSPHERE AS DETERMINED FROM FLUCTUATIONS. Edmonds, F. N. Jr.

(Texas Univ., Austin (USA)). Solar Phys.; 38: No. 1, 33–41(Sep 1974).

The fractional convective flux πF_c $(\chi_c)/\pi F$ is computed for the effective level $\chi_e = \log\tau_c = 0.125$, using bi-dimensional co-spectra for relative continuum-brightness fluctuations ΔI measured for the CI 5052.16 spectral line. A more uncertain flux for $\chi_{F_e} \sim -0.9$ is obtained for the Fe I 5049.83 line. Since the results incorporate current uncertainties in $RMS_{\Delta I}$, $RMS_{\Delta V}$ and $RMS_{\Delta T(\chi)}$, where ΔT are photospheric temperature fluctuations, they must be considered qualitative until these uncertainties are appreciably reduced. The requirement that the fractional convective flux < 1, places restrictions on these uncertainties which suggest that current $RMS_{\Delta T}$ (χ)'s are too large. The results confirm the importance of overshoot at the top of the solar hydrogen convection zone and suggest a non-negligible fractional convective flux throughout the lower photosphere. Qualitatively, they do not agree with the predictions of the generally-used, local, mixing length theory or those of Parsons' (1969) modified mixing-length theory. However, qualitative agreement with the predictions of the nonlocal, generalized mixing-length theory of Spiegel (1963) and with the nonlocal theory of Ulrich (1970) cannot be considered as observational confirmation of these theories. (auth)

14903 OBSERVATIONS OF PHOTOSPHERIC FACULAE AT THE CENTER OF THE SOLAR DISK. Mehltretter, J. P. (Sacramento Peak Observatory, Air Force Cambridge Research Laboratories, Sunspot, N. M., 88349, USA). Solar Phys.; 38: No. 1, 43-57(Sep 1974).

Observations, in the near uv with very high spatial resolution, obtained with the Sacramento Peak Vacuum Tower Telescope, show that photospheric faculae are visible near the center of the disk. Faculae consist of bright point-like structures with typical dimensions of 100 to 200 km, and appear to be concentrated in the intergranular space. Preliminary results on measurements of size, brightness, life time, and on interaction of facular structures with granulation are presented, which support the view that faculae are identical with the recently discovered "solar filigree." Phenomenological arguments are discussed concerning the suggestion that facular points may represent magnetic flux concentrations in the photosphere. (auth)

14904 STUDIES OF SOLAR MAGNETIC FIELDS. II. The Magnetic Fluxes. Howard, R. (Hale Observatories, Pasadena, Calif. (USA)). Solar Phys.; 38: No. 1, 59-67(Sep 1974).

Magnetic flux data from the Mount Wilson magnetograph are examined over the interval 1967-1973. The total flux in the north is greater than that in the south by about 7% over this interval, reflecting a higher level of activity in the northern hemisphere. Close to 95% of the total flux is confined to latitudes equatorward of 40°, which means that close to 95% of the flux cancels with flux of opposite polarity before it can migrate poleward of 40°. It is pointed out that a consequence of this flux distribution is that ephemeral regions must make a negligible contribution to the long-term large-scale magnetic flux distribution. A broad peak in the total flux may be seen centered about one year after activity maximum in the north below 40°. In the south there is a very sharp increase in flux about the same time. In the north, several poleward migrations of flux may be seen. Two of these may correspond with the two poleward prominence migrations seen by Waldmeier. In both the north and the south there is a poleward migration of negative flux about the time of activity maximum. Poleward flux drift rates are about 20 ms^{-1}. (auth)

14905 A VELOCITY ERROR IN BABCOCK-TYPE MAGNETOGRAPHS. Frazier, E. N. (Aerospace Corp., Los Angeles, Calif. (USA)). Solar Phys.; 38: No. 1, 69-72(Sep 1974).

A few years ago it was discovered that Babcock-type magnetographs yield an erroneously low value of the magnetic field strength when the line Fe λ5250.2 is used. This has led to a number of papers which have investigated the source of that error. It is now rather well established that the source is twofold: The line is weakened due to higher temperature in the magnetic region, and the line suffers Zeeman saturation due to very high field strengths. The purpose of this note is to point out that an associated error exists in the velocities observed with these magnetographs, and to show that this error can be explained easily and even utilized to derive yet more information on the fine structure of magnetic field regions. (auth)

14906 THE RELATION BETWEEN THE INTENSITIES OF UMBRA AND PENUMBRA OF LARGE SUNSPOTS. Ekmann, G. (Oslo Univ. (Norway). Institutt for Teoretisk Astrofysikk). Solar Phys.; 38: No. 1, 73-75(Sep 1974).

Based on pinhole photometer observations in 4 to 6 wavelength regions a connection between the intensities of the umbra and the penumbra of sunspots has been searched for. For the 1.67 μm wavelength region it is apparent that spots with dark umbrae also have dark penumbrae. In the other wavelength regions similar relations are found. The darkness of the spot is probably connected with the degree of complexity of the spot. (auth)

14907 HIGH-RESOLUTION PHOTOGRAPHY OF THE SOLAR CHROMOSPHERE. XIV. Morphology of Sunspots at the Chromospheric Level. Loughhead, R. E. (National Standards Lab., Sydney (Australia)). Solar Phys.; 38: No. 1, 77-89(Sep 1974).

A detailed description is given of the morphology of two isolated, fairly regular sunspots based on high-resolution observations obtained at seven wavelengths in the Hα line with a spectral purity and discrimination not hitherto achieved. Photometric traces across one of the spots confirm an earlier conclusion that the umbra–penumbra boundary is diffuse near the line centre but sharp in the wings. They also reveal considerable changes in the intensity contours of a sunspot from line centre to wings. (auth)

14908 STUDIES OF K LINE FILTERGRAMS. Zirin, H. (Hale Observatories, Pasadena, Calif. (USA)). Solar Phys.; 38: No. 1, 91-108(Sep 1974).

High-resolution filtergrams made with a 0.3 Å K line filter at Big Bear are discussed. The dark K3 clouds noted in spectra by Bappu and Sivaraman (1971) are confirmed; they cover about ⅓ of the inside of supergranule cells, and oscillate (mainly horizontally) with 3 to 4 min period. Their vertical extent of about 3000 km produces a sharp broadening of K3 at the extreme limb and obscuration of bright features. Spicules also produce K3 absorption, but they occur in emission more often than in Hα, particularly near the limb. Apart from these differences the structures seen in Hα and K generally correspond. A fine structure of granule size, also oscillating with 3 to 4 min period, is seen in K1. This structure is also obscured near the extreme limb, possibly by the same clouds seen in K1. The bright K232 network does not appear to oscillate significantly in brightness, except through covering and uncovering by the overlying dark clouds. Some bright spicules, and many dark ones, are seen over all elements of the K network, as in Hα. In active regions the structure in K is very close to Hα; all plagettes and plages are bounded by systems of strongly inclined bright and dark fibrils apparently marking the lines of force. The fibrils are the same (bright or dark) in Hα and K3; they are not seen in K2. Umbral flashes are much less visible in Hα. There is, however, a finer, granular umbral structure in Hα which does not oscillate. Running penumbral waves are not seen in K. The penumbra and surrounding areas are bright in K3. Every bright point in K3 corresponds to a magnetic field spot, except for the intranetwork area, where the magnetograms cannot detect possible fields. Flares are the same in K and Hα. The formation of the K double reversal at the limb is exhaustively discussed. (auth)

14909 AN EMPIRICAL INTERPRETATION FOR THE TIME EVOLUTION OF THE Ca II K LINE. Liu, S. Y. (Hale Observatories, Pasadena, Calif. (USA)); Skumanich, A. (National Center for Atmospheric Research, Boulder, Colo. (USA)). Solar Phys.; 38: No. 1, 109-115(Sep 1974).

An empirical approach to interpret the time evolution of the high spatial resolution Ca II K line is presented. The physical parameters such as electron temperature, hydrogen density, and velocity (microturbulent and systematic) are specified as functions of height. The electron density is obtained from scaled non-LTE solutions for hydrogen ionization. The population indices, and thus the Ca II source functions, for a 5-level Ca II atom are computed by using the generalized Newton–Raphson method. K line profiles are then synthesized for different evolutionary stages and are compared with the observed ones. The explanation of the "peculiar" type profile is also attempted. (auth)

14910 A DIFFUSE COMPONENT IN THE Hα CHROMOSPHERIC NETWORK. Giovanelli, R. G. (National Standards Lab., Sydney (Australia)). Solar Phys.; 38: No. 1, 117-125(Sep 1974).

Observations are described of diffuse material in and around the chromospheric network which lowers the intensity there in the core of Hα, and is detected best at Hα ± 0.5 Å. This material seems to be responsible for the Hα central reversal in spicules, has typically $N_e \sim 3 \times 10^{10}$ cm^{-3} and $T_e \lesssim 3 \times 10^4$K, and is probably related to the network seen in rocket spectroheliograms. It is confined mainly within a height of 3500 km and has a typical lateral extent of about 15000 km. (auth)

14911 FIRST PHASE OF ACTIVE REGIONS AND THEIR RELATION TO THE CHROMOSPHERIC NETWORK. Born, R. (Fraunhofer Institut, Freiburg, F. R. Germany). Solar Phys.; 38: No. 1, 127-131(Sep 1974).

An analysis of 63 young active regions shows that they originate exclusively on the borders of the chromospheric cells. In most cases they do not produce pores or spots, but always "arch filament systems" and chromospheric faculae. The "arch filament systems" evolve along the cell border, they are rooted on the network and not in the interior of the chromospheric cells. The subphotospheric magnetic flux seems to reach the photosphere in units of 10^{19} Mx. About 3 hr after the first "arch filaments" appear pores evolve on the cell border. The pores and spots are probably formed by local aggregations of the emerging flux tubes. (auth)

14912 USE OF COLOUR TO DISPLAY THE CIRCULAR POLARIZATION IN SOLAR DYNAMIC SPECTRA. Suzuki, S. (Commonwealth Scientific and Industrial Research Organization, Epping (Australia). Div. of Radiophysics). Solar Phys.; 38: No. 1, 3-7(Sep 1974).

Equipment has been developed to display in color any circular polarization in the dynamic spectra of solar radio emissions. The potential and limitations of this simple equipment are discussed on the basis of a sample record. Modifications, now under development, to improve the system are described. (auth)

Galaxies

14913 STRUCTURE OF THE MILKY WAY. I. A Radio Continuum Survey of the Galactic Plane at 408 MHz. Green, A. J. (Max-Planck-Institut fuer Radioastronomie, Bonn). Astron. Astrophys., Suppl. Ser.; 18: No. 2, 267-307(Nov 1974).

A continuum survey was made at 408 MHz of part of the galactic plane. The region with galactic latitudes $|b^{II}| \leq 3°$ and galactic longitudes l^{II} 195°–360°–55° was observed, using the Molonglo radiotelescope, which has an effective beamwidth of 2.86′ (R. A.) × 2.88′ sec z (dec.). Absolute brightness temperatures were calculated for the total radiation and for the background contribution, with sources excluded. The temperatures were averaged over strips and the results are given as a longitude distribution. Line scan diagrams, 6° × 6°, were prepared for the most interesting sections of the survey, and cover the region l^{II} 255°–360°–51°. From these maps a search was made for possible new supernova remnant identifications. (auth)

14914 COHERENT MOLECULAR RADIATION. Litvak, M. M. (Harvard College Observatory, Cambridge, MA). Annu. Rev. Astron. Astrophys.; 12: 97-112(1974).

This field is reviewed in terms of nonthermal populations, pumping models, apparent maser size, signal bandwidth, and polarization. (WDM)

14915 LARGE-SCALE DYNAMICS OF THE INTERSTELLAR MEDIUM. Kaplan, S. A. (Gorky Radiophysical Research Inst., USSR); Pikel'ner, S. B. Annu. Rev. Astron. Astrophys.; 12: 113-133(1974).

Topics considered include density waves in a homogeneous medium, spiral waves in a thin rotating gas disk, spiral density waves in rotating gas–star disk, dynamics of the outer regions of the Galaxy, physical properties of interstellar shocks, spiral shocks, formation of HI clouds and complexes, and star formation. (WDM)

14916 RADIO RADIATION FROM INTERSTELLAR MOLECULES. Zuckerman, B. (Univ. of California, Berkeley); Palmer, P. Annu. Rev. Astron. Astrophys.; 12: 279-313(1974).

The present review is concerned with the astrophysics of interstellar radio molecules. Topics covered include equation of transfer, estimates of molecular projected densities, optically dark nebulae, envelopes around far infrared sources and H II regions, molecular clouds associated with far infrared sources and H II regions, protostellar and stellar sources, the galactic center and galactic structure, isotopic abundances, and isotropic background radiation. (WDM)

14917 NUCLEO-COSMOCHRONOLOGY. Schramm, D. N. (Univ. of Texas, Austin). Annu. Rev. Astron. Astrophys.; 12: 383-406(1974).

Nucleo-cosmochronology is currently capable of obtaining model-independent results about the age and history of the Galaxy. However, detailed conclusions about galactic evolution cannot at present be given because of the large uncertainties in the input parameters. Future measurements, particularly on the ^{244}Pu problem, the development of the ^{187}Re chronology, and the development of the ^{247}Cm chronology could enable significant improvement in the state of r-process chronology. The development of ^{146}Sm as a p-process chronometer and ^{205}Pb as an s-process chronometer would also be an important breakthrough in the field, as would the development of any other chronometer. With the recent advances in mass spectrometry it is certain that new developments in this field should be forthcoming shortly. (auth)

14918 ORIGIN OF THE LIGHT ELEMENTS. Reeves, H. (CEN de Saclay, Gif-sur-Yvette, France). Annu. Rev. Astron. Astrophys.; 12: 437-469(1974).

Topics covered in this review include an historical background, observations, phases of nucleosynthesis, and origins. (WDM)

14919 POSSIBLE INFLUENCE OF COMETS ON THE CHEMICAL EVOLUTION OF THE GALAXY. Tinsley, B. M. (Texas Univ., Dallas (USA)); Cameron, A. G. W. (Harvard Coll. Observatory, Cambridge, Mass. (USA)). Astrophys. Space Sci.; 31: No. 1, 31-35(Nov 1974).

It has been suggested by Cameron that a cloud of comets containing a mass of condensable elements, comparable to the mass of such elements in the Sun, formed on the outskirts of the solar system. If the formation of such comet clouds is a general feature of star formation, they constitute a significant sink of elements heavier than helium. It is shown here that this process provides a possible explanation for the very slow rate at which the mean metal abundance of disk stars has increased during the lifetime of the Galaxy. (auth)

14920 THE MODE OF CREATION OF STARS, STELLAR SYSTEMS AND THE HUBBLE SYSTEM OF GALAXIES. Piddington, J. H. (National Standards Lab., Sydney (Australia)). Astrophys. Space Sci.; 31: No. 1, 225-240(Nov 1974).

It is confirmed that the creation of stars in spiral (and perhaps also Irr I) galaxies requires a physical parameter (X factor) additional to gas density. Consequently the X factor is an essential feature of stellar patterns and perhaps of stellar systems (spiral and other disk and spheroidal systems, globular clusters) and may be the key to the origin of the few, yet remarkably varied Hubble system of galaxies. (i) It is shown that the X factor is organized over the whole galaxy and is a function of azimuth ψ as well as radius r. Only a galaxy-wide force field seems capable of explaining such an $X(r,\psi)$ factor, either magnetic or gravitational in origin. (ii) If gravitational in origin, the X factor must be a shock wave, but a survey of observations in eight galaxies, including our own, shows no large-scale shocks associated with star creation. This provides further strong evidence against the density–shock theory of twin spiral arms. (iii) It is confirmed that galaxies of different Hubble types did not evolve from one another, so that each protogalaxy must possess a genetic factor which predetermines its evolution, and in particular its stellar systems. Thus the protogalactic genetic factor may be identical with the X factor. (iv) The case for a primordial magnetic field is strengthened and it is shown that in our Galaxy and some others the field must be generally oblique to the disk. Such a field can explain the $X(r,\psi)$ factor in terms of a magneto-gravitational mechanism of gas clumping. (v) An earlier, hydromagnetic theory of the Hubble types and of radio galaxies is extended by including the X factor to explain the various stellar systems observed in spiral, elliptical, lenticular and irregular galaxies. (auth)

14921 MEAN FREE PATH LIMITATION OF CONDUCTION ELECTRONS AND EXTINCTION EFFICIENCIES OF GRAPHITE GRAINS. Wickramasinghe, N. C.; Lukes, T.; Dempsey, M. J. (University Coll. of South Wales and Monmouthshire, Cardiff (UK)). Astrophys. Space Sci.; 30: No. 2, 315-325(Oct 1974).

An extended Drude theory taking account of the limited free path of conduction electrons in small particles is used to calculate size dependent complex refractive indices of graphite spheres from bulk refractive index data. The size dependent refractive indices are then used in conjunction with the Mie theory to compute mean extinction efficiencies of graphite spheres. Significant departures from earlier results are found. (auth)

14922 CONTENT AND STRUCTURE OF GALAXIES AS OBSERVED WITH LST. King, I. R. (Univ. of California, Berkeley). pp 23-27 of Large Space Telescope: A New Tool for Science. New York; American Inst. of Aeronautics and Astronautics, Inc. (1974).

From 12th aerospace sciences meeting; Washington, DC (30 Jan 1974).

It is pointed out that the particular capabilities of the Large Space Telescope (LST) make it especially suitable for the study of galaxies because of the faintness of these distant objects. The limitations of ground-based observations in astronomy are examined. Extragalactic programs for the LST will be of several types, depending on the distances of the objects being studied and the faintness of the stars within them. (IAA)

Cosmology

14923 (ORNL-4953) USE OF SUPERNOVAE LIGHT CURVES FOR TESTING THE EXPANSION HYPOTHESIS AND OTHER

COSMOLOGICAL RELATIONS. Rust, B. W. (Oak Ridge National Lab., Tenn. (USA)). Dec 1974. Contract W-7405-eng-26. 400p. Dep. NTIS $10.60.

Thesis.

The aim of this thesis was to put the expanding universe hypothesis to an observational test by using light curves for 37 supernovae. A value of H = 92/km/sec/M_{pc} was obtained for the Hubble constant. (WDM)

14924 PERTURBATIONS OF SPACE–TIMES IN GENERAL RELATIVITY. Stewart, J. M.; Walker, M. (Max-Planck-Institut fuer Physik und Astrophysik, Munich). Proc. Roy. Soc. (London), Ser. A; 341: No. 1624, 49-74(29 Oct 1974).

A definition of perturbations of space–time in general relativity is proposed. The definition leads in a natural way to a concept of gauge invariance, and to an extension of a lemma of Sachs (Relativity, groups and topology. Gordon and Breach, New York. (1964)). Coupled equations governing linearized perturbations of certain tetrad components of scalar, electromagnetic, and gravitational fields are derived by the use of Geroch, Held, and Penrose's version (J. Math. Phys.; 14: 874 (1973)) of the tetrad formalism of Newman and Penrose (J. Math. Phys.; 3: 566 (1962)). It is shown that these perturbations are gauge invariant if and only if the unperturbed space-time is vacuum of algebraic type {22} or, equivalently, if and only if the perturbation equations decouple. Finally the maximal subclass of type {22} space-times for which the decoupled perturbation equations can be solved by separation of variables is found. This class comprises all the nonaccelerating type {22} space–times, including that of Kerr thus elucidating earlier results of Bardeen and Press (J. Math. Phys.; 14: 7 (1973)) and Teukolsky (Astrophys. J.; 185: 635 (1973)). (auth)

14925 GRAVITATION AND LONG-RANGE WEAK INTERACTIONS IN NEUTRINO FIELDS. A Contribution to the Theory of Solar Neutrinos. Treder, H. J. (Sternwarte, Babelsberg, Ger.). Astron. Nachr.; 295: No. 4, 169-184(1974). (In German).

A revision of the theory of weak interactions in their relation to gravitation is considered which takes cognizance of the failure of the Davis experiment to demonstrate a solar neutrino current. The treatment retains features of the current stellar models and accepts Pauli's hypothesis on the connection between gravitation and weak interactions. Thus the gravitational constant is regarded as the square of the corresponding Fermi interaction constant; the Riemann–Einstein gravitational metric represents the fusion of four algebraically independent Weyl neutrino fields (beta- or mu- neutrinos and antineutrinos), resulting from the formation of four reference tetrads as neutrino-current vectors with a concomitant definition of the gravitational metric according to Einstein's theory of teleparallelism in Riemannian space-times. These procedures lead to a new metric which only affects neutrinos and causes a redshift weakening of all cosmic neutrino emissions, thus making them undetectable. (IAA)

14926 EXISTENCE AND THE DENSITY OF INTERGALACTIC DUST. Schmidt, K. H. (Sternwarte, Babelsberg, Ger.). Astron. Nachr.; 295: No. 4, 163-168(1974).

A relation between the redshift z of QSOs and their color index (B–V) prime corrected for line emission and galactic absorption is interpreted in terms of an intergalactic selective extinction. The observed amount of extinction corresponds to a density of intergalactic dust grains at about 10^{-34} to 10^{-33} g/cm^3 at z = 0. The lifetime of these particles is estimated to be longer than the Hubble time at present. But at large z the lifetime of the grains considerably depends on the flux density of cosmic rays. Some implications of the existence of intergalactic dust are discussed. (auth)

14927 WHY IS THE UNIVERSE HOMOGENEOUS. Clutton-Brock, M. (Newcastle upon Tyne Univ. (UK). Dept. of Physics). Astrophys. Space Sci.; 30: No. 2, 395-408(Oct 1974).

The very early universe must have been extremely homogeneous, even on scales far exceeding the particle horizon. Within the framework of the standard Friedmann cosmology, homogenization can only be achieved by quantum effects which violate classical causality. This could happen when the particle horizon was smaller than the Compton wavelength of the pion. The assumption that statistical departures from equilibrium started to grow after this epoch leads to a prediction of the density fluctuations at recombinations. The amplitude ν of the fluctuations should have a maximum of about 0.007 on scales of 8×10^{17} M. For smaller scales, $\nu \propto M^{+\frac{1}{6}}$, and for larger scales, $\nu \propto M^{-\frac{1}{6}}$. This suggests that superclusters condense out at a redshift of about 11, and clusters and then galaxies form shortly after by fragmentation. (auth)

Planetary Phenomena

Refer also to abstract 15492.

14928 CENTRIFUGAL INSTABILITY OF THE JOVIAN MAGNETOSPHERE AND ITS INTERACTION WITH THE SOLAR WIND. Michel, F. C. (Rice Univ., Houston, TX); Sturrock, P. A. Planet. Space Sci.; 22: No. 11, 1501-1510(Nov 1974).

The outer regions ($r > 2.3\ R_J$; R_J = radius of Jupiter) of the magnetosphere of Jupiter will systematically accumulate plasma. If sufficient plasma accumulates, the field lines must open to allow the plasma to escape. Available energy sources appear able to supply plasma at a high enough rate to keep the field lines constantly open beyond about 60 R_J. It is suggested that the solar wind interaction with Jupiter may be essentially different from that with the Earth, with the Jovian magnetosphere opening up to form a planetary wind. (auth)

14929 ANNUAL REVIEW OF EARTH AND PLANETARY SCIENCES. Volume I. Donath, F. A.; Stehli, F. G.; Wetherill, G. W. (eds.). Palo Alto, CA; Annual Reviews Inc. (1973). 356p. $12.00.

Separate abstracts were prepared for two of the thirteen papers. (WDM)

For abstracts of individual chapters see: 14930 and 14974.

14930 INTERIOR OF JUPITER AND SATURN. Hubbard, W. B. (Univ. of Texas, Austin). Annu. Rev. Earth Planet. Sci.; 1: 85-106(1973).

The current state of understanding of the interior structure of Jupiter and Saturn is reviewed in terms of both the theoretical work accomplished to date and pertinent observational data. The current status of constituent relations necessary for modeling is discussed: thermodynamic variables and transport coefficients. After reviewing pertinent observational data, the theory of the external gravitational field is discussed, using a somewhat unconventional approach. Some of the proposed interior models are considered. (WDM)

14931 PLANETARY ACCRETIONS IN JET STREAMS. Ip, W. H. (California Univ., La Jolla, San Diego (USA). Dept. of Applied Physics and Information Science). Astrophys. Space Sci.; 31: No. 1, 57-79(Nov 1974).

The problem of planetary accretion in a jet stream is studied using the model developed by Alfvén and Arrhenius. It is found that there are basically three types of planetary accretion: namely, fast process ($\tau_c < \tau_i$), slow process ($\tau_c \sim \tau_i$), and delayed process ($\tau_c > \tau_i$) where τ_c is the characteristic time of the occurrence of catastrophic accretion and τ_i the time-scale of mass injection to the planetary system ($\simeq 3 \times 10^8$ yr). These different time scales of accretion are found to be closely related to the primordial thermal profiles and equatorial inclinations of the planets. Finally, Venus' retrograde rotational spin is shown to be a possible result of accretion process in a jet stream. (auth)

14932 DRAGFREE SPACEPROBE. Kundt, W. (Bielefeld Univ. (F.R. Germany). Fakultaet fuer Physik). Astrophys. Space Sci.; 30: No. 2, 455-461(Oct 1974).

Dragfree missions are needed for very accurate planetary sounding, and for testing of Einstein's theory of gravity. With the state-of-the-art technology, drag compensation in the approximate plane of a spaceprobe orbit is feasible down to 10^{-13} g ($g = 10^3$ cm s^{-2}); for the out-of-plane component, the achievable dragfree level is only 10^{-12} g. However, future technology (larger launchers, electric propulsion) can decrease these limits. (auth)

PHYSICS (ATMOSPHERIC)

Auroral and Ionospheric Phenomena

14933 (AD-780033) PLASMA MODIFICATION ASSOCIATED WITH PARAMETRIC INSTABILITIES DRIVEN BY INTENSE ELECTROMAGNETIC WAVES. Final Technical Report. Flick, James T.; Hendel, H. W. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). Apr 1974. Contract F30602-73-C-0163. 36p. NTIS $3.25.

The purpose of the experimental effort is to study, in laboratory plasma, effects relating to observations of enhanced absorption of electromagnetic waves in the ionosphere. The experiments were performed in a q-machine plasma, which has comparable ion and electron temperatures, similar to the ionosphere. The isothermal $T_e = T_i$ parametric ion acoustic decay instability, expected to cause modification of the ionosphere upon irradiation by intense electromagnetic waves $\omega_0 \leq \omega_{pe}$ was studied in detail in laboratory q-machine plasmas. The instability is conclusively identified by wavelength and frequency measurements. Other parameters determined are instability threshold and maximum acoustic frequency dependence upon density; instability bandwidths and spatial profiles; electron and ion heating—all in agreement with linear, homogeneous theory. Not in agreement with theory are relations between lf, hf and pump intensities. (auth)

14934 (AD-782099) CONVERSION OF AN ION-ACOUSTIC WAVE BY COLLISIONS TO A NEUTRAL SOUND WAVE IN A NONHOMOGENEOUS PLASMA. Ong, R. S. B.; Pian, C. C. P. (Michigan Univ., Ann Arbor (USA)). May 1974. 86p. (AFOSR-TR-74-1137). NTIS $4.00.

Thesis.

The collisional coupling of low frequency ion-acoustic waves and neutral sound waves propagating downward in the ionosphere is investigated. The ionosphere is considered as a nonhomogeneous weakly ionized plasma consisting of electrons, ions and neutrals. The equations of conservation of mass, momentum, and energy of the three species constitute the basic equations for the analysis. The plasma is assumed to be electrically neutral. Collisional energy transfer between the hot electrons and the colder neutrals are taken into account. The coupled differential equations for the wave amplitudes are solved analytically. (auth)

14935 (COM-74-50087-357) IONOSPHERIC DATA. (National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo. (USA)). May 1974. 119p. (NOAA-FA-357). National Climatic Center, Asheville, N. C. 28801 $1.00.

The publication contains monthly medians for the same month the publication is issued. For example, the January 1973 issue includes all the data available for January 1973 and any previous unpublished data for January from earlier years. Also published are detailed data for the same month from an exemplary station, Wallops Island (Washington) including daily-hourly values of all characteristics, F-plots for regular world days, and an N(H) contour graph. As timely information, there is included selected ionospheric data for a retrospective world interval, when appropriate. Also given is information on ionospheric data recently received at World Data Center A for solar-terrestrial physics and other information on availability of data from the WDC's. This issue also contains tables and graphs of monthly median ionospheric data for May 1957 and each May to that of 1973. (GRA)

14936 THEORY OF E REGION RECOMBINATION PROCESSES. Van Zandt, T. E. (National Oceanic and Atmospheric Administration, Boulder, CO). Ann. Geophys.; 30: 21-30(1974).

From 2nd conference of the International Association of Geomagnetism and Aeronomy; Kyoto, Japan (9 Sep 1973).

The theory of three F-region recombination processes is reviewed, namely that of dissociative recombination, radiative recombination, and ion-ion recombination. In particular, new developments and certain aspects of the ion chemistry, not treated previously, are discussed. (IAA)

14937 IONOSPHERE-PLASMASHEET FIELD-ALIGNED CURRENTS AND PARALLEL ELECTRIC FIELDS. Lemaire, J.; Scherer, M. (Institut d'Aeronomie Spatiale de Belgique, Brussels). Planet. Space Sci.; 22: No. 11, 1485-1490(Nov 1974).

Two kinetic models for the auroral topside ionosphere are compared. The collisionless plasma distributed along an auroral magnetic field line behaves like a non-Ohmic conducting medium with highly non-linear characteristic curves relating the parallel current density to the potential difference between the cold ionosphere and the hot plasmasheet region. The (zero-electric current) potential difference, required to balance the current carried by the precipitating plasmasheet particles and the current transported by the outflowing ionospheric particles, depends on the ratio $n_{ps.e}/n_{th.e}$ and $T_{ps.e}/T_{th.e}$ of the plasmasheet and ionospheric electron densities and temperatures. When in the E region the magnetic field lines are interconnected by a high conductivity plasma the resulting field-aligned currents driven by the magnetospheric potential distribution are limited by the integrated Pedersen conductivity of the ionospheric layers. These currents are not related to the parallel electric field intensity as they would be in Ohmic materials. The parallel electric field intensity is necessarily determined by the local quasi-neutrality of the plasma. (auth)

14938 Pi-2 PULSATIONS AS A RESULT OF EVOLUTION OF AN ALFVEN IMPULSE ORIGINATING IN THE IONOSPHERE DURING A BRIGHTENING OF AURORA. Maltsev, Y. P.; Leontyev, S. V.; Lyatsky, W. B. (Polar Geophysical Inst., Apatity, USSR). Planet. Space Sci.; 22: No. 11, 1519-1533(Nov 1974).

It is assumed that the original impulse producing Pi-2 pulsations is generated in the ionosphere at the moment of a brightening of aurora. The electric field is known to decrease in the auroral arc almost by an order of magnitude. The electric impulse that appears will be transferred along magnetic field lines and reflected from the ionosphere of the opposite hemisphere, forming the standing Alfvén wave. The electric field impulse of 100 mV/m is capable of causing magnetic field oscillations of order of 100 γ. Reflection of the Alfvén impulse from the ionosphere with horizontal inhomogeneities corresponding to different forms of auroras is studied. The following is found: (a) the resonance is possible only for harmonics with the rotating vector of polarization; (b) the resonance periods appear to depend essentially on the ionospheric conductivity; this may bring a significant error into determination of the magnetospheric plasma density from the pulsation periods; (c) the auroral zone exerts a screening influence on the pulsations excited at latitudes higher than the zone itself. (auth)

14939 SOLAR IONIZING RADIATION. Friedman, H. (Naval Research Lab., Washington, DC). J. Atmos. Terrest. Phys.; 36: No. 12, 2245-2253(Dec 1974).

An historical survey is presented of the use of rockets and satellites to probe the structure and composition of the upper atmosphere and to explore the full spectrum of solar radiation responsible for the production and control of the ionosphere. The subject is dealt with under the following headings: broad band photometry; an early (1954) model of the production of the ionosphere; solar ultraviolet spectroscopy; solar flares; eclipse studies of solar active regions; distribution of sources of ionizing radiation on the solar disk; satellite observations. (UK)

14940 IONOSPHERIC SPREAD-F AT HUANCAYO, SUNSPOT ACTIVITY AND GEOMAGNETIC ACTIVITY. Bowman, G. G. (Queensland Univ., Brisbane). Planet. Space Sci.; 22: No. 11, 1579-1583(Nov 1974).

A superposed-epoch method is used to investigate the occurrence of spread-F at Huancayo relative to days of high sunspot activity and also relative to days of high geomagnetic activity. A good correlation is found between days of high A_p index and high spread-F occurrence for a pre-sunrise interval of a few hours. When 3-hourly K_p indices are used they show a peak value approximately 6 hr prior to an above-average occurrence of spread-F. It is suggested that this pre-sunrise spread-F is associated with ionospheric height rises which are produced by travelling disturbances, initiated in polar regions at times of high geomagnetic activity. (auth)

14941 HYDROMAGNETIC WAVES IN A VISCOUS ANISOTROPICALLY CONDUCTING IONOSPHERIC PLASMA. Lehmann, H. R.; Treumann, R.; Johanning, D. (Heinrich-Hertz-Institut fuer Solar-Terrestrische Physik, Berlin). Gerlands Beitr. Geophys.; 83: No. 2-3, 113-120(1974). (In German).

A dispersion relation describing the propagation of low-frequency waves in a viscous anisotropically conducting plasma is derived in an approximation of nonideal magnetohydrodynamics. An analysis of the special case of wave propagation normal to the external magnetic field shows that an undamped high-velocity magnetoacoustic wave can propagate through the ionosphere in this direction. Neither conductivity nor viscosity have an effect on the phase velocity of the wave. Acoustic waves propagating

parallel to the external magnetic field will experience a viscous damping effect. (IAA)

14942 IONOSPHERIC DYNAMO-ELECTRIC FIELDS. Moehlmann, D. (Heinrich-Hertz-Institut fuer Solar-Terrestrische Physik, Berlin). Gerlands Beitr. Geophys.; 83: No. 2-3, 101-112 (1974).

Using a perturbation-theoretical method to solve the ionospheric potential equation, analytical solutions are derived to describe the ionospheric electrostatic field in dependence of the ionospheric wind fields. This method gives, to a good approximation, the following dynamo model: Wind-driven currents in the lower and upper E regions give rise, with preference in these layers, to the charge accumulations producing the ionospheric electrostatic fields. These two regions are coupled strongly with each other, due to the relatively great parallel conductivity. The resulting total electrostatic field is practically a superposition of the fields generated in the regions mentioned. (auth) (IAA)

14943 IONOSPHERIC MODIFICATION THEORY: PAST, PRESENT, AND FUTURE. Meltz, G. (Raytheon Co., Sudbury, MA); Perkins, F. W. Radio Sci.; 9: No. 11, 885-888(Nov 1974).

Ionospheric modification theory is reviewed and the principal phenomena are discussed in the context of present understanding. One fundamental advance has been the recognition that differential heating in collisional plasmas due to the beating of high frequency waves can generate low-frequency density fluctuations more effectively than ponderomotive forces. This thermal coupling between the disturbing wave and density fluctuation plays a central role in producing field-aligned structure. Future applications of ionospheric modification in trans-equatorial scatter communications and D-, E-, and F-region aeronomy are also discussed. (auth)

14944 SUMMARY OF VERTICAL INCIDENCE RADIO OBSERVATIONS OF IONOSPHERIC MODIFICATION. Utlaut, W. F.; Violette, E. J. (Inst. for Telecommunication Sciences, Boulder, CO). Radio Sci.; 9: No. 11, 895-903(Nov 1974).

Within the past four years, experiments with high-power, high-frequency radio waves have proved the feasibility of temporarily altering the ionosphere's properties. Many different radio and photometric effects have been observed as a result of the ionospheric modification. This paper provides a survey of some of the effects observed with vertical incidence radio techniques when the US Department of Commerce's Platteville facility, near Boulder, Colorado, is used to illuminate the overhead ionosphere with an equivalent isotropically radiated power of the order of 100 Mw. A variety of different and repeatable phenomena are observed to occur in the F region. A few always occur; for others, apparently, certain ionospheric conditions must exist. E-region effects observed by these techniques are small, but substantial effects are noted in the D region. (auth)

14945 HF PHASED ARRAY OBSERVATIONS OF HEATER-INDUCED SPREAD-F. Allen, E. M.; Thome, G. D.; Rao, P. B. (Raytheon Co., Sudbury, MA). Radio Sci.; 9: No. 11, 905-916 (Nov 1974).

A large circular hf phased array radar has been used to study the angular spectrum of spread-F returns from an ionosphere modified by the intense radio waves from the high power Platteville transmitter. The results obtained are presented to show the dependence of angular spectrum on range delay, Doppler shift, operating frequency, and on the power of the heater transmitter. The phenomenon of wideband attenuation observed with the o-mode diagnostic wave is examined for its dependence on the angle of arrival of the received signal. The angular spectrum of the spread-F returns exhibits a systematic behavior. It is found that the angle of arrival migrates from north to south and the Doppler changes from positive to negative as the range delay examined is changed from the leading edge of the return to the trailing edge. The height dependence of the angular spectrum shows that the volume containing the spread-F irregularities is aligned along the Earth's magnetic field. The dependence on the heater power is such that the angular extent of the returns is reduced by a factor of 3 when the heater power is reduced to -9 db of its maximum value of 1.8 Mw. The attenuation suffered by the diagnostic o-mode upon heater turn-on changes with the angle of arrival to reach a maximum with the signal returns arriving from the south. It is shown by means of ray-tracing simulation that the observed interdependence of angle of arrival, Doppler shift, and range delay is consistent with a model of field-aligned ducts for the heater-induced spread-F irregularities. The model, when applied to the conditions at Arecibo and the results compared to that for Platteville, reveals that the range delay spread is about the same and the angular spread is approximately in the same ratio as the heater beamwidths at the two places. (auth)

14946 FIRST OBSERVATIONS OF rf BACKSCATTER FROM FIELD-ALIGNED IRREGULARITIES PRODUCED BY IONOSPHERIC HEATING. Thome, G. D.; Blood, D. W. (Raytheon Co., Sudbury, MA). Radio Sci.; 9: No. 11, 917-921(Nov 1974).

A series of experiments was conducted with hf and vhf radars at White Sands, New Mexico, during the months of October 1970 and June 1971 to search for direct rf backscatter from ionospheric irregularities produced by the Platteville heater. The observations were made from White Sands because radars at this location view the heated volume normal to the Earth's magnetic field lines. Direct echoes from the heated volume were unquestionably observed. Returns were obtained at frequencies up to the highest available at the hf radar site: 30 MHz during the first series of observations and 54 MHz during the second. The echoes were observed only after sunset, at times when the local plasma frequency over Platteville was of the order of 5 MHz at the layer maximum. The total radar scattering cross section of the heated volume was found to decrease with increasing frequency and to vary from less than 10^4 m^2 (the minimum detectable cross section) to 10^9 m^2, depending on frequency and time of day. The Doppler spectrum of the returns indicated that the drift velocity of the scatterers through the heated volume was greater than the relative velocity between scatterers and comparable to the drift velocity of natural irregularities at mid-latitudes. (auth)

14947 FIELD-ALIGNED SCATTERING FROM A HEATED REGION OF THE IONOSPHERE. Observations at hf and vhf. Fialer, P. A. (Stanford Research Inst., Menlo Park, CA). Radio Sci.; 9: No. 11, 923-940(Nov 1974).

Radio scattering measurements have been made of a region of the ionosphere above the Institute for Telecommunication Sciences' ionospheric heating facility at Platteville, Colorado. Strong scattering was observed at frequencies in the hf and vhf bands. The scattering has been shown to originate from electron density fluctuations that are highly elongated in the direction of the geomagnetic field. Radar scattering cross sections of 70 to 80 dbsm are measured in the hf and low vhf bands. The scattering cross section decreases at a rate of 20 to 30 db per octave at the high end of the vhf band. The scattering irregularities are produced by operation of the heating facility with o-mode polarization at frequencies that reflect within the ionosphere. The strength of the scattered energy decreases at a rate of at least 10 db per degree for observation geometries that do not match the geometry for specular reflections from long cylinders aligned with the geomagnetic field. The spatial distribution of irregularities has been estimated for both E- and F-region heating. The temporal properties of the scattering have also been determined including the frequency spectrum of the scattered signals. The processes by which ionospheric heating produces these irregularities are not yet fully explained. Several potentially useful applications of radio scattering from such irregularities are discussed. (auth)

14948 RADIO FREQUENCY SCATTERING FROM A HEATED IONOSPHERIC VOLUME I. vhf uhf Field-Aligned and Plasma-Line Backscatter Measurements. Minkoff, J.; Kugelman, P.; Weissman, I. (Riverside Research Inst., New York). Radio Sci.; 9: No. 11, 941-955(Nov 1974).

It is observed that an ionospheric volume in the F layer subjected to high power hf illumination becomes an effective scattering medium for radio signals in the vhf uhf frequency range. The experimental results are representative of a field-aligned scattering geometry for which the first such observations of vhf uhf scattering from a heated ionospheric volume are presented. Two distinct scattering modes are observed, center-line and plasma-line scattering. Center-line scattering is observed at the transmitted radar frequency f; plasma-line scattering is observed as a pair of sidebands at $f \pm f_h$ where f_h is the heater frequency. The two scattering modes are observed to have markedly dissimilar characteristics. Center-line scattering is highly aspect sensitive with respect to the direction of the geomagnetic field, B; plasma-line scattering is found to be much less aspect sensitive, if at all. The region of maximum backscatter for the center-line mode is found from these measurements to consist of the locus of points within the heated volume over which perpendicularity between the radar line of sight and B is achieved, independent of the location of maximum heating. The backscattering region for the plasma-line mode is found from these measurements to be determined by the altitude of maximum heating, independent of geometrical considerations involving B. The longitudinal coherence length, L, for center-line scattering is found from these measurements to be greater than the maximum antenna diameter of 85 ft; no more exact estimate for L is possible. A striking reversal in frequency dependence is found between the center-line and plasma-line modes.

The per-unit-volume center-line backscatter cross section is found to be about 7 db greater at vhf than at uhf; the per-unit-volume plasma-line backscatter cross section is found to be at least 11 db less at vhf than at uhf. Preliminary results concerning time-dependent behavior are presented. For both modes the scattering cross section is found to be effectively turned on and off very rapidly in response to the heater excitation; the spectral width of the scattering for both modes is found to be quite narrow (about 10 Hz). The spatial configuration of the heated volume is investigated; significant differences are observed depending on whether f_0/f_0F_2 is greater or less than unity. (auth)

14949 RADIO FREQUENCY SCATTERING FROM A HEATED IONOSPHERIC VOLUME II. Bistatic Measurements. Minkoff, J.; Laviola, M.; Abrams, S.; Porter, D. (Riverside Research Inst., New York). Radio Sci.; 9: No. 11, 957-963(Nov 1974).

A variety of bistatic experiments which were carried out for the purpose of determining the scattering properties of the heated ionospheric volume in the F layer over Platteville, Colorado, are described. Results are presented on the basis of which it was first determined that the center-line scattering takes place from elongated field-aligned scattering structures. Measurements are presented showing that, for the center-line mode, the scattering of the incident signal consists, effectively, of specular reflections off the geomagnetic field lines. (auth)

14950 RADIO FREQUENCY SCATTERING FROM A HEATED IONOSPHERIC VOLUME III. Cross Section Calculations. Minkoff, J. (Riverside Research Inst., New York). Radio Sci.; 9: No. 11, 997-1004(Nov 1974).

The proper normalization procedure for determining per-unit-volume properties of aspect-sensitive scattering media from experimental measurements is discussed. This is complicated by the fact that, because of the aspect sensitivity, it is not clear a priori what the per-pulse scattering volume actually is. In general, the correct normalization requires quantitative knowledge of the aspect sensitivity which may not be possible to determine because of fundamental limitations imposed by the spatial-resolution capability of the measurement system on the extent to which this property of the scattering medium can actually be determined. The identical problem exists in radio-auroral measurements. This problem is considered here, and an exact expression from which the desired per-unit-volume quantities of interest can be obtained from measurements is given. It is shown that proper choice of the experimental parameters leads to a simplification whereby the normalization can be carried out without knowledge of the aspect sensitivity being necessary. The results are applied to calculating from experimental data the per-unit-volume scattering properties of a heated ionospheric volume as a function of frequency, from which a transverse scale size for the scattering medium of 3 m is estimated. For these experiments, under maximum heating conditions, a representative value of 1% for the rms fractional electron density deviation is calculated; an upper bound is also established showing that values as large as 4 or 5% were probably never achieved. It is shown that, for an electron density distribution axially symmetric with respect to the geomagnetic field, B, the cross section for backscatter within a plane containing B uniquely determines the cross section for bistatic scattering axially around B. Experimental results for small axial-bistatic angles are presented showing good agreement between calculated and measured values. (auth)

14951 VHF AND UHF BISTATIC OBSERVATIONS OF A REGION OF THE IONOSPHERE MODIFIED BY A HIGH POWER RADIO TRANSMITTER. Carpenter, G. B. (Stanford Research Inst., Menlo Park, CA). Radio Sci.; 9: No. 11, 965-969(Nov 1974).

vhf and uhf bistatic radar investigation of a region of the ionosphere modified by a high power transmitter has revealed two modes of scatter. The modes are described in association with parameters of the scatter region and of the received signals. (auth)

14952 SATELLITE TRANSMISSION STUDIES OF SPREAD-F PRODUCED BY ARTIFICIAL HEATING OF THE IONOSPHERE. Bowhill, S. A. (Aeronomy Corp.; Champaign, IL). Radio Sci.; 9: No. 11, 975-986(Nov 1974).

Experiments are described to study the morphology of artificial spread-F (ASF) irregularities by measuring the scintillation of vhf and uhf signals transmitted through the disturbed region from geostationary and orbital satellites. The ASF irregularities are found to be approximately field aligned with correlation distances of about 100 m transverse to the field direction; a smaller structure less than 10 m is also seen. The fluctuations seem to be distributed through the entire F layer and are less than one percent of the ambient electron density at most times. (auth)

14953 MODEL FOR rf SCATTERING FROM FIELD-ALIGNED HEATER-INDUCED IRREGULARITIES. Rao, P. B.; Thome, G. D. (Raytheon Co., Sudbury, MA). Radio Sci.; 9: No. 11, 987-996 (Nov 1974).

The paper presents a model for radio wave scattering from the ionospheric irregularities generated by the intense radio wave transmissions from the Platteville heater. The model is based upon the hf–uhf radar backscatter observations for a physical description of the scattering medium and upon the theory of weak scattering (Born approximation) from anisotropic irregularities for mathematical development. According to the model, the electron density fluctuations responsible for radio wave scattering having an rms value of 1 to 1.5% are aligned along the Earth's magnetic field and are distributed in a diffuse pancake-shaped volume of 15 km gaussian thickness vertically and of the size of the heater beam which is 100 km in gaussian diameter horizontally. At radio frequencies the irregularities within the disturbed volume are highly aspect sensitive and consequently only those scatters which lie on the surface of specularity where a radar views transverse to the magnetic field count in contributing to the received signal. Model computations have been made of the scattering cross sections for monostatic as well as bistatic radar configurations and they are found to be in good agreement with the observations. The radar cross section at a given frequency for bistatic geometry is substantially greater than that for monostatic geometry, all else being equal. Finally, it is shown that the width of the scatter-illuminated bands on the ground is set primarily by the finite dimensions of the scattering volume rather than by the finite aspect sensitivity of the individual scatterers. (auth)

14954 MODEL OF THE ENHANCED AIRGLOW EXCITED BY rf RADIATION. Haslett, J. C. (Space Environment Labs., Boulder, CO); Megill, L. R. Radio Sci.; 9: No. 11, 1005-1019 (Nov 1974).

A phenomenological model of the enhanced airglow produced by the Department of Commerce ionospheric modification facility is presented. This model is based primarily on airglow data taken from two sites for triangulation. These data show that it is not necessary for the region in which rf power is deposited (interaction region) to be coincident with the region in which the modified airglow is emitted (excitation region). The two are coincident at altitudes below 280 ± 15 km; but, as the interaction region rises, the two may separate with the excitation region remaining at altitudes around 280 km. It is also shown that a non-Maxwellian energy distribution for electrons is generated by the transmitter. Further, using this model, estimates are presented of the efficiency for converting the radio wave energy into energetic electrons. This can typically be 1%, although observations indicating efficiencies 10 to 15 times higher have been made. A variety of experimental data which are not clearly understood are also presented. (auth)

14955 ARECIBO HEATING EXPERIMENTS. Gordon, W. E. (Rice Univ., Houston, TX); Carlson, H. C. Jr. Radio Sci.; 9: No. 11, 1041-1047(Nov 1974).

Enhancements of various features of the incoherent scatter spectrum are observed when the ionosphere is illuminated with powerful, high-frequency radio waves. The radio waves excite plasma instabilities producing lines or more complex spectral features near the local plasma frequency, at the local ion-acoustic frequency, near the local gyrofrequency, and near twice the gyrofrequency. The enhancements occur in a thin slab as observed by the incoherent scatter radar and at both upshifted and downshifted frequencies with respect to the probing radar frequency. The enhancements are observed to vary with time when the excitation is held constant and is turned on or off. The high-power radio waves are produced by a 160 kw transmitter feeding a log-periodic pair of curtains mounted at the focus of the 1000-ft reflector and covering the frequency range from 5 to 12 MHz. The effects are observed with the incoherent scatter radar using the same reflector and with ionosondes and photometers. The frequencies of the enhanced plasma line and the ion line and their relation to the pump (high frequency radio wave) frequency are predictable from available parametric instability theory. Other spectral features are being explained as the theory develops with the help of the observations. There remain some discrepancies, in particular the asymmetries in intensity, width, and fluctuations of the upshifted compared to the downshifted plasma lines. (auth)

14956 IONOSPHERIC HEATING BY POWERFUL RADIO WAVES. Meltz, G. (Raytheon Co., Sudbury, MA); Holway, L. H. Jr.; Tomljanovich, N. M. Radio Sci.; 9: No. 11, 1049-1063(Nov 1974).

In addition to the communication applications that stem from the generation of field-aligned irregularities, ionospheric heating by powerful hf waves also holds promise for establishing

new techniques in D-, E-, and F-region aeronomy. This paper concentrates on the application of the theory of plasma heating by ohmic and nonlinear dissipation to the special conditions of the lower ionosphere where the electron collision and disturbing wave frequencies are comparable and the upper ionosphere where electron thermal transport is large and restricted by the Earth's magnetic field. The magnitude and distribution of large-scale changes in the electron temperature and density in both the D and F layers under a variety of conditions are predicted. These results are compared with direct measurements or inferred changes whenever possible. The effects of specular-height mismatch, multiple frequency operation involving heater-power sharing, and antenna beam tilt on the total cross section for field-aligned scattering were also examined. The analysis is based on the concept that the energy-density distribution on the heater reflectrix computed by means of a ray-tracing technique can be related directly to the density-fluctuation intensity through an appropriate scattering model. Lastly, potential applications to aeronomy are discussed, particularly in regard to D-region measurements of the effective recombination coefficient magnitude and temperature dependence and the relative water cluster ion concentration. (auth)

14957 THEORETICAL MODEL FOR SHORT-SCALE FIELD-ALIGNED PLASMA DENSITY STRIATIONS. Perkins, F. W. (Princeton Univ., NJ). Radio Sci.; 9: No. 11, 1065-1070(Nov 1974).

The short-scale (about 3 m), field-aligned plasma density striations found in ionospheric modification experiments are generated by the plasma turbulence resulting from ion acoustic-plasma wave parametric decay instabilities. The field-aligned geometry results from the fact that nonlinear wave coupling arises from thermal, ohmic heating terms rather than ponderomotive force (radiation pressure). The theory shows that field-aligned striations increase rapidly in intensity as the wavelength increases — in agreement with experiment. (auth)

14958 GENERATION OF LARGE-SCALE FIELD-ALIGNED IRREGULARITIES IN IONOSPHERIC MODIFICATION EXPERIMENTS. Cragin, B. L. (Univ. of California, San Diego, La Jolla); Fejer, J. A. Radio Sci.; 9: No. 11, 1071-1075(Nov 1974).

The threshold of the purely growing mode of stimulated Brillouin scattering is exceeded in ionospheric modification experiments for horizontal wavelengths longer than about half a km. The "beat wavelength" along the field lines is a few km long and increases with decreasing height. The irregularities are therefore not purely field aligned initially although diffusion across the field lines could, over longer periods of time, produce purely field-aligned irregularities which persist after the heating transmitter is switched off. (auth)

14959 ELECTRON ACCELERATION BY PARAMETRICALLY EXCITED LANGMUIR WAVES. Fejer, J. A. (Max-Planck-Institut fuer Aeronomie, Lindau/Harz, Ger.); Graham, K. N. Radio Sci.; 9: No. 11, 1081-1084(Nov 1974).

Simple physical arguments are used to estimate the downward-going energetic electron flux due to parametrically excited Langmuir waves in ionospheric modification experiments. The acceleration mechanism is a single velocity reversal as seen in the frame of the Langmuir wave. The flux is sufficient to produce the observed ionospheric airglow if focusing-type instabilities are invoked to produce moderate local enhancements of the pump field. (auth)

14960 ENHANCED AIRGLOW, ELECTRON ACCELERATION, AND PARAMETRIC INSTABILITIES. Weinstock, J. (Aeronomy Lab., Boulder, CO). Radio Sci.; 9: No. 11, 1085-1087(Nov 1974).

A calculation is made of the acceleration of electrons during ionospheric modification experiments. The electrons are accelerated by Langmuir waves excited unstable by the parametric instability. This calculation results in an electron flux of about 10^9 cm^{-2} sec^{-1} for conditions over Boulder and is sufficient to explain observations or airglow enhancements. (auth)

14961 SUGGESTIONS FOR FUTURE RESEARCH IN hf IONOSPHERIC MODIFICATION. Sweeney, L. E. Jr. (Stanford Research Inst., Menlo Park, CA). Radio Sci.; 9: No. 11, 1089-1090(Nov 1974).

This paper summarizes suggestions for future research in the modification of the ionosphere by high powered hf radio waves. The research areas discussed include both theoretical and experimental work to: (1) better define and explain known phenomena, (2) verify the existence and establish the properties of effects that have been tentatively observed, (3) discover new effects, and (4) develop applications of known phenomena to science and engineering. (auth)

14962 STUDIES OF THE EQUATORIAL ANOMALY IN THE F-REGION AND THE UPPER IONOSPHERE WITH SPHERICAL ION TRAPS ON THE INTERCOSMOS-2 SATELLITE. Gdalevich, G.; Gorozhankin, B.; Kutiev, I.; Samardzhiev, D.; Serafimov, K. Izv. Geofiz. Inst., Bulg. Akad. Nauk.; 19: 71-83(1974). (In Bulgarian).

14963 DETERMINATION OF MEAN ELECTRON DENSITY PROFILES IN THE IONOSPHERIC D LAYER FROM RADIO WAVE PROPAGATION MEASUREMENTS. Bremer, J.; Singer, W. (Observatorium fuer Ionosphaerenforschung, Kuehlungsborn, Ger.). Gerlands Beitr. Geophys.; 83: No. 2-3, 217-236(1974). (In German).

Mean electron density profiles of the D and E region are derived for summer conditions, low solar activity, medium geographic latitudes, and solar zenith angles 40, 60, 70, and 80°. Generalized averages of numerous profiles taken from literature, mostly rocket measurements, have been adapted to experimental data of radio wave propagation. By the profiles derived in this way, the ionospheric absorption in the lf and hf range and the critical frequencies of the E layer as well as the phase heights in the lf range and their dependence on solar zenith angle can be satisfactorily interpreted. Finally, the influence of the seasonal variation of collision frequency on radio wave propagation has been investigated. It can be shown that the changed profile of collision frequency during winter causes an increase of ionospheric absorption and a decrease of the phase heights and, therefore, may play an important role in the problem of winter anomaly. (auth)

14964 TRAVELLING IONOSPHERIC PERTURBATIONS AND DIFFUSION OF IONIZATION. Broche, P. (Univ., Toulon, France). Ann. Geophys.; 30: 71-77(1974). (In French).

From 2nd conference of the International Association of Geomagnetism and Aeronomy; Kyoto, Japan (9 Sep 1973).

Coupling between the movement of ionized particles and neutral particles due to a medium scale traveling disturbance in the F region and middle latitudes is studied with particular attention to the effects of ionization diffusion. With several models of perturbation, it is shown that the diffusion does not considerably modify the coupling properties but sometimes may magnify variations of electron density. A physical interpretation of the mechanism is given. (auth)

14965 SURVEY OF SATELLITE AND GROUND BASED MEASUREMENTS OF PHOTOELECTRON EXCITED EMISSIONS. Carlson, H. C. (Univ. of Texas, Dallas). Ann. Geophys.; 30: 59-69(1974).

From 2nd conference of the International Association of Geomagnetism and Aeronomy; Kyoto, Japan (9 Sep 1973).

Recent studies of photoelectron excited emissions are reviewed, and some of their implications for knowledge advances in geophysics are discussed. Photoelectron excited airglow emission lines so far observed are shown to have been usefully applied in studies of a variety of geophysically interesting parameters. These include diurnal and seasonal and longer-term variations of neutral atmospheric densities (O, N_2, He) and variations in solar euv. (IAA)

14966 A STUDY ON THE LATITUDINAL FEATURES OF THE IONOSPHERIC ABSORPTION EXCURSION. Lunetta, M. (Sao Paulo Univ. (Brazil). Instituto de Fisica). Rev. Brasil. Fis.; 1: No. 3, 369-379(Dec 1971).

The range of absorption variation, termed here as "Ionospheric Absorption Excursion" is studied, making use of the average differences between the upper and the lower deciles of absorption. The behavior of this parameter is discussed for low and middle latitude ionospheric conditions. The relative importance of this parameter in the F-region and the lower ionosphere is then considered using the latitudinal variation in the F-region absorption expected from the observed latitudinal variation in the critical frequency of the F_2 layer. (INIS)

14967 PLASMA CONVECTION IN POLAR IONOSPHERE. Galperin, Yu. I.; Ponomarev, V. N.; Zosimova, A. G. (Institut Kosmicheskikh Issledovanii, Moscow). Ann. Geophys.; 30: 1-7 (1974).

From 2nd conference of the International Association of Geomagnetism and Aeronomy; Kyoto, Japan (9 Sep 1973).

A review is presented of the vertical and horizontal components of the ionospheric plasma convection velocity measured in October–November 1967 on the satellite Cosmos 184 in polar circular orbit at an altitude of about 630 km. The convection pattern above the auroral ovals is found to be in approximate agreement with the results obtained from the OGO-6 satellite. During the most intense breakup of the storm on November 3, 1967, a jet was formed in a direction opposite to the growing and bifurcating

westward electrojet at its equatorial edge. This is interpreted as a polarization due to anomalous parallel resistivity. The persistence of a banded convection pattern above the nonsunlit polar cap after the storm suggests a slow relaxation of the tail pressure gradients normal to the neutral sheet. (IAA)

14968 SATELLITE MEASUREMENTS OF PHOTOELECTRON FLUXES. Wrenn, G. L. (University Coll., London). Ann. Geophys.; 30: 49-57(1974).

From 2nd conference of the International Association of Geomagnetism and Aeronomy; Kyoto, Japan (9 Sep 1973).

A review is given on current techniques used on satellites for measuring photoelectron fluxes. Retarding potential traps and electrostatic analyzers are described, and obtained measurements are discussed in terms of energy and pitch-angle distribution, total flux, and the trapped nature of the photoelectron population. (IAA)

14969 THEORY OF PHOTOELECTRON PRODUCTION, TRANSPORT, AND ENERGY IONS. Nagy, A. F. (Univ. of Michigan, Ann Arbor). Ann. Geophys.; 30: 43-48(1974).

From 2nd conference of the International Association of Geomagnetism and Aeronomy; Kyoto, Japan (9 Sep 1973).

Current understanding of the theory of ionospheric photoelectron production, transport and energy loss is summarized. The various approaches used in the theoretical calculations of photoelectron fluxes appear to be self consistent and sound; improved values for a number of input parameters are needed now in order to achieve significant improvements and more confidence in the results. The major remaining problem in the present day theory of photoelectron transport and energy loss is centered around the calculations of photoelectron transit through the protonosphere. (auth) (IAA)

14970 SURVEY OF THE ULTRAVIOLET AIRGLOW FROM 1216 to 304 A. Meier, R. R. (Hulburt Center for Space Research, Washington, DC). Ann. Geophys.; 30: 91-104(1974).

From 2nd conference of the International Association of Geomagnetism and Aeronomy; Kyoto, Japan (9 Sep 1973).

The airglow and celestial background in this region of the spectrum has been observed from some eight rocket flights, from the Space Test Program STP 72-1 satellite, and from the lunar surface during the Apollo-16 mission. The interval from 800-1216 A is rich in spectral population, containing emissions from N, N_2, O, H, and several ionized species. Probable excitation mechanisms for these emissions include resonance scattering, photoelectron impact and dissociative excitation, and radiative recombination. Below 800 A, He I 584 A and He II 304 A, both produced by resonance scattering of sunlight, appear to be the principal spectral features. The 584 A emission is found to be a sensitive measure of the latitudinal-seasonal variation of neutral helium (the winter bulge). Analysis of the 304 A observations shows that it is possible to determine optically the plasmasphere morphology and its dynamic behavior. (auth)

14971 OXYGEN AIRGLOW EMISSIONS AND THE DYNAMICS OF THE UPPER ATMOSPHERE. Dachs, J. (Ruhr Univ., Bouchum, Ger.). Ann. Geophys.; 30: 85-90(1974). (Kyot).

From 2nd conference of the International Association of Geomagnetism and Aeronomy; Kyoto, Japan (9 Sep 1973).

The knowledge of airglow emitting reactions and atmospheric composition may be used to interpret the observed temporal and geographic intensity variations of oxygen airglow emissions in terms of circulation systems and dynamical processes in the upper atmosphere changing the local densities of excited oxygen atoms and molecules. The correlations which have been found between ionospheric parameters and oxygen nightglow intensity measurements are reviewed in order to show that horizontal and vertical plasma drifts and neutral winds in the F2 and E regions of the ionosphere can be studied by recording the daily variations of visible and ultraviolet oxygen airglow line emissions. Evidence is presented that the seasonal intensity variations of the forbidden O I 5577-A nightglow emission found at many ground-based observations are related to seasonal variations of the local atomic oxygen densities at the 100-km height level of the atmosphere. (auth)

Magnetospheric Phenomena

Refer also to abstract 14813.

14972 (TRITA-EPP-73-16) LABORATORY EXPERIMENTS OF MAGNETOSPHERIC INTEREST. Faelthammar, C. G. (Kungliga Tekniska Hoegskolan, Stockholm (Sweden)). Oct 1973. 44p. Dep. NTIS (US Sales Only) $5.25.

Space-related laboratory experiments can play an important role as a complement to observations and active experiments in the magnetosphere. Excluding laboratory experiments for mere developing or testing of techniques for space experiments, we may distinguish between two major types: (1) Partial scale model experiments and (2) Experiments for clarifying basic plasma physical processes known or expected to be important in the magnetosphere (but without the ambition to simulate actual space configurations). The limitations and potentialities of both types are discussed and examples of experiments are given. It is concluded that there should be an increasing need for the experiments of the second type. In particular, they are needed for the clarification of the response of a thin plasma to electric fields and its ability to carry electric currents. This encompasses such key questions as the nature and role of "anomalous" resistivity (and electron runaway in its presence), the possible formation of double layers (and the acceleration processes associated with them) and rapid dissipation of magnetic-field energy. (auth)

14973 MAJOR AURORAL SUBSTORM FEATURES IN THE DARK SECTOR OBSERVED BY A USAF DMSP SATELLITE. Snyder, A. L. Jr. (Offutt Air Force Base, Omaha, NE); Akasofu, S. I. Planet. Space Sci.; 22: No. 11, 1511-1517(Nov 1974).

Synoptic auroral photographs acquired by a United States Air Force DMSP satellite have provided the data necessary for an improved understanding of the common auroral phenomena that occur during the substorm expansive phase. Specifically, it is recognized that diffuse auroras (patches, large scale wave structures and Omega bands) form an integral part of the auroral substorm and that their morphological features should be added in the substorm pattern proposed by Akasofu (Planet. Space Sci.; 12: 273 (1964)). Several other important auroral substorm features have been added to or corrected in the original pattern. A revised substorm pattern at about the maximum epoch of the substorm is presented. (auth)

14974 MAGNETOSPHERIC ELECTRONS. Coroniti, F. V.; Thorne, R. M. (Univ. of California, Los Angeles). Annu. Rev. Earth Planet. Sci.; 1: 107-129(1973).

Low-energy auroral electrons (0.1 to 10 keV) are discussed. The marcoscopic characteristics of these electrons are determined by convective transport and precipitation sinks. The transport of the higher energy (>40 keV) Van Allen electrons to deep inside the plasmasphere is probably controlled by inward radial diffusion. The observed precipitation loss and pitch-angle distributions of plasmaspheric Van Allen electrons are now in excellent agreement with the theoretical calculations by Lyons et al (1972). (WDM)

14975 PERIOD VARIATION OF Pc5 PULSATIONS AT HIGH LATITUDES. Gupta, J. C. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). Earth Physics Branch). Astrophys. Space Sci.; 31: No. 1, 81-101(Nov 1974).

Geomagnetic data for the year 1967 from seven Canadian observatories, spanning the sub-auroral, auroral, and polar zones, have been analyzed to investigate the characteristic variation of Pc5 period with several geophysical variables. Pulsations in the whole spectrum of Pc5 (period range 150 to 600 s) were found to occur at all of the observatories. Those with smaller periods occurred more frequently at lower latitudes while those with longer periods occurred more frequently at higher latitudes. Daily variation of the periods of Pc5 showed little change with seasons or with magnetic activity. Periods, in general, had two daily maxima which appeared at different local times in different zones. A predominant morning peak was noted at all stations except Baker Lake, where a mid-day maximum of the period was found. The Pc5 periods tended to increase with geomagnetic activity at lower latitude stations, and to decrease with activity at stations in the polar cap for low to moderate Kp levels. At high activity levels these trends appeared to reverse, though results are less certain. In different seasons and for the whole year the periods increased almost linearly with latitude. However when similar analysis was done for individual hours of the day and for different magnetic activity groups, this linear relationship between period and geomagnetic latitude was not evident. Efforts to detect a 27-day recurrence tendency of Pc5 periods did not succeed. (auth)

14976 PARTICLE LIFETIMES IN STRONG DIFFUSION. Schulz, M. (Aerospace Corp., El Segundo, Calif. (USA). Space Physics Lab.). Astrophys. Space Sci.; 31: No. 1, 37-42(Nov 1974).

The mean lifetime τ of a particle distribution, driven to isotropy by intense pitch-angle diffusion, is calculated by analytical means for conditions applicable to the Earth's magnetosphere. The resulting algebraic expressions reduce to $\tau \sim [64La/35\nu a_c^3 (1-\eta)]$ in the limit of a small equatorial loss cone (half-angle α_c), where ν is the particle speed, L is the magnetic shell parameter, a is the radius of the Earth, and η is the particle albedo from the at-

mosphere at either foot of the field line. Distinction is made in the full expressions for τ between complete isotropy (caused by strong pitch-angle diffusion all along the field line) and incomplete isotropy (caused by strong diffusion that is localized at the magnetic equator) over the upward hemisphere in velocity space. (auth)

14977 EXISTENCE AND STABILITY OF STRONG POTENTIAL DOUBLE LAYERS. Knorr, G.; Goertz, C. K. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy). Astrophys. Space Sci.; 31: No. 1, 209-223(Nov 1974).

An elementary integral equation technique is used to construct strong and weak stationary shock solutions from the one-dimensional Vlasov equation. It is shown that the plasma is Penrose stable in all points in space under certain conditions. (auth)

14978 WAVE-COUPLING AT THE MAGNETOPAUSE. Rajaram, R.; Kalra, G. L.; Tandon, J. N. (Delhi Univ. (India). Centre for Advanced Study in Physics). Astrophys. Space Sci.; 31: No. 1, 143-153(Nov 1974).

The paper considers wave coupling for an arbitrary direction of propagation on the basis of single fluid hydromagnetic equations appropriate for a rarefield plasma. The analysis is used to study the transfer of solar wind momenta into the magnetosphere. It is found that wave refraction is significant only during disturbed conditions for waves travelling with the wind. Enhanced reflection of waves might be important even under quiet conditions in the flanks of the magnetosphere. (auth)

14979 DOES A "TWO-STREAM" FLOW MODEL APPLY TO WAKES OF LARGE BODIES IN SPACE. Samir, U. (Michigan Univ., Ann Arbor (USA). Space Physics Research Lab.); Stone, N. H.; Oran, W. A. (National Aeronautics and Space Administration, Huntsville, Ala. (USA). George C. Marshall Space Flight Center). Astrophys. Space Sci.; 31: No. 1, L1-L8(Nov 1974).

Structural patterns of ion and electron currents observed on the wake axes of the Ariel I and the Gemini 10 space vehicles are re-examined, together with relevant theoretical and laboratory "simulation" studies. Some insight into existing in-situ data is provided. The possibility that "converging-stream" models describe structural features of current enhancements in the wake region of large spacecraft is discussed. (auth)

14980 NEUTRAL POINT PHENOMENA. Schlindler, K. (Max-Planck-Institut fuer Physik und Astrophysik, Garching, Ger.). pp 41-54 of Proceedings of the Summer School on Plasma Physics and Solar Radioastronomy. Mangeney, A. (ed.). Meudon, France; Observatoire de Paris-Meudon.

From summer school on plasma physics and solar radioastronomy; Ile de Re, France (4 Sep 1972).

The properties associated with neutral regions are recalled (loss of particle gyroscopic properties and changes in the topology of the magnetic field). A classification of neutral point phenomena is then given. Neutral point phenomena in the magnetosphere are studied together with particle acceleration. (auth)

14981 DISTANT BOW SHOCK OBSERVATIONS BY EXPLORER 33. Mihalov, J. D. (National Aeronautics and Space Administration, Moffett Field, Calif. (USA). Ames Research Center). Astrophys. Space Sci.; 30: No. 2, 447-454(Oct 1974).

Locations, orientations, and magnetic field changes are given for 135 bow shock crossings at distances downstream from Earth between 84 and 117 Earth radii. The shock locations bracket those calculated for the hypersonic analogue by Dryer and Heckman for a Mach number of 3.8. The shock normal vectors have been calculated using magnetic coplanarity. The average normal vectors have a greater inclination by $\sim 17 \pm 5$ deg from the symmetry axis than the Dryer and Heckman shock orientations for a 3.8 Mach number. Over a range of downstream distances from 60 to 115 Earth radii, the median magnetic field magnitude jump across the shock changes from 1.90 to 1.70 times. (auth)

PHYSICS (ATOMIC AND MOLECULAR)

Beams and Their Reactions

Refer also to abstract 15030.

14982 (FRNC-TH-504) ION FORMATION FROM ATOMS EJECTED IN SELF-IONIZING STATES DURING THE CATHODE SPUTTERING OF TRANSITION METALS AND THEIR ALLOYS. Blaise, G. (Paris-11 Univ., 91—Orsay (France)). 1972. 181p. (In French). Dep. NTIS (US Sales Only) $12.25.

Thesis.

Ion emission from transition metals and their alloys was studied, a microanalyzer being used. A description is given of a high resolution method for analyzing the energy distribution of secondary ions using a counter-field obtained with an electrostatic mirror incorporated into the apparatus. This mirror enabled work functions of metals and alloys to be obtained very simply and changes in surface potential due to gas adsorption to be followed. The experimental results obtained for the ion yields and energy distributions of simple ions are interpreted in terms of an external excitation emission process based on the formation of self-ionizing states. The results can most probably be extended to polyatomic ions. The existence of two effects was established. The probability of the formation of self-ionizing states in atoms and the subsequent ionization probability are closely related to the local electronic structure of the atoms in question in the bulk of the metal or alloy considered. This relation is particularly relevant for alloys in which a bound virtual state exists. The energy distribution of the slowest ions depends on the structure of the self-ionizing configurations. (auth)

14983 (IPNO-73-04) PROGRESS REPORT FOR 1973 ON THE CONFINED HEAVY ION SOURCE. Arianer, J.; Baron, E.; Ton-That, T.;. (Paris-11 Univ., 91—Orsay (France). Inst. de Physique Nucleaire). 1973. 15p. (In French). INIS.

Studies carried out over the past 2 years by the Heavy Ion Source group of the Institute of Nuclear Physics to develop a Donetz scheme based multicharged heavy ion source are reported. The confinement principle is recalled together with the operation of this type of source. The characteristics of the Orsay model are described: directly heated electron gun; pressure of between 2 to 4.10^{-8} torr, Debye length; slowing down and stability of the beam; confinement time. The tube desorption products are currently limited to H_2, C, O, and to a lesser extent N. Methods are currently being studied for reducing the desorption by the walls. The current gun can reach current-densities of between 10^4 and 10^5 A/cm^2. (auth)

14984 (ORO-2591-74) FORMATION OF EXCITED HYDROGEN AND HELIUM BY H^+ AND He^+ IMPACT ON METAL SURFACES. Thomas, E. W. (Georgia Inst. of Tech., Atlanta (USA). School of Physics). 1974. 8p. (CONF-741209-2). Dep. NTIS $4.00.

From general meeting of the American Physical Society; Atlanta, Georgia, USA (5 Dec 1974).

Helium and hydrogen impact on aluminium, copper, nickel, and molybdenum at 20 to 30 keV is studied regarding line shapes and line intensities. (JFP)

14985 METHOD AND MEANS FOR UTILIZING ACCELERATED NEUTRAL PARTICLES. Zehr, P. J.; Lank, M. M. T.; Lank, P. (to Reactor Accelerator Development International Inc.). US Patent 3,846,636. 5 Nov 1974. Filed date 31 Aug 1971. 8p.

The invention resides in the utilization of radiant energy by bringing together accelerated positive ions and accelerated electrons or accelerated negative ions to produce accelerated neutral particles the energy of which may then be converted to heat on bombardment of particles of an appropriate reactant, or utilized in other ways as in neutral particle radiography. (Official Gazette)

14986 EFFECT OF THE LATTICE-ATOM THERMAL VIBRATIONS ON THE REFLECTION OF IONS FROM A SINGLE CRYSTAL. Karpuzov, D. S. (Bylgarska Akademiya na Naukite, Sofia). Surface Sci.; 45: No. 2, 342-352(Oct 1974).

Computer simulation of the reflection of a keV ion beam from a single crystal is carried out for different target temperatures. Ar ions bombarding obliquely a Cu lattice with 2 keV, and a Ni crystal with 30 keV energy are considered. The potentials used are of Born–Mayer ($Ae^{-r/\rho}$) and Firsov (Br^{-2}) types, respectively. Uncorrelated thermal vibrations of atoms with Gaussian distribution of their displacements are taken into account. The spatial and energy distribution of the reflected ions obtained for different temperatures are discussed. The energy spectra are compared with the experimental data for the same conditions. (auth)

14987 ANGULAR DISTRIBUTION OF FAST SECONDARY ELECTRONS RELEASED DURING IONIC BOMBARDMENT OF A SOLID. Soszka, W.; Lipiec, J. (Uniwersytet Jagiellonski, Krakow (Poland). Instytut Fizyki). Surface Sci.; 45: No. 2, 371-376 (Oct 1974).

A multi-grid analyzer with a segmental collector and phase-sensitive detecting system were used to study the energy distributions of secondary electrons emitted by the surface of a copper polycrystal bombarded with 2 keV He^+ ions. It is shown that a peak of autoionization electrons of an energy of about 35 eV appears only for small outlet angles (i.e. the angle between the target surface and detection direction). At large outlet angles, near 75°, no autoionization electrons were detected. On the basis of the anisotropy of autoionization electrons outlet directions, an estimate is made of the lifetime of the autoionization state. (auth)

14988 DESTRUCTION OF NEGATIVE IONS NEAR SOLID STATE SURFACES. Janev, R. K. (Observatoire de Paris, Section de Meudon, 92 (France)). Surface Sci.; 45: No. 2, 609-618 (Oct 1974).

The problem of destruction of a negative ion in a slow collision with a metallic surface is considered. It is shown that the electron exchange between the atomic and metallic potential wells is the most important destruction mechanism for the negative ions. The electron transition probability of this process is calculated by a method which provides asymptotically exact results. (auth)

14989 SCATTERING OF POTASSIUM ATOMIC BEAMS FROM VARIOUS CLEAVED SURFACES. Tomoda, S.; Kodera, K. (Kyoto Univ. (Japan). Faculty of Science); Kusunoki, I. (Tohoku Univ., Sendai (Japan). Research Inst. for Scientific Measurements). Surface Sci.; 45: No. 2, 657-676(Oct 1974).

Scattering of potassium atomic beams from cleaved surfaces of LiF, KCl and mica were studied. The observed spatial distributions follow the cosine distribution in most cases. At large incident angles the distributions from LiF and KCl deviate from the cosine and show apparent backscatterings. A simple model is proposed to interpret the backscattering in terms of macroscopic roughness of cleaved surfaces. The sticking coefficient S(t) is defined, and the mass balance between the incident and outgoing atoms is examined. Mass balance holds within the limits of errors on the surfaces of LiF and KCl at temperatures above 400°K. On a mica surface deposition of potassium atoms is observed even at temperatures higher than room temperature. It is shown from the change of the sticking coefficient that the deposition does not proceed linearly in the initial period. (auth)

14990 DIFFRACTION OF THE SECONDARY ELECTRONS EMITTED BY AN ION SINGLE CRYSTAL UNDER IONIC BOMBARDMENT. Mischler, J.; Benazeth-Colombie, N. (Univ., Toulouse). Delft Progr. Rep., Ser. B; 278: No. 17, 775-777 (22 Apr 1974). (In French).

The angular distribution of the secondary electrons of given energy, emitted from a single crystal Fe(c.c.) target bombarded perpendicularly with Ar^+ ions is studied. The results obtained for the incident particle velocities below 5.10^7cm/s confirm an hypothesis proposed for Cu, according to which anisotropy is due to secondary electron diffraction. (auth)

14991 HIGH INTENSITY PROTON SOURCE. Layton, J. K.; Magnuson, G. D. (to Secretary of the Air Force). US Patent 3,843,889. 22 Oct 1974. Filed date 29 Nov 1973. 4p.

A proton source in which hydrogen is heated by a tungsten filament in a chamber is described. The chamber is surrounded by an anode cylindrically shaped and having an orifice for the expulsion of protons. The chamber is mounted between two stainless steel support posts which are then mounted upon a supporting disk. The hydrogen is introduced to the chamber by a gas line embedded in one of the support posts. A pair of heat shields surround the anode and have orifices concentric with the anode's orifice. (auth)

14992 LUMINESCENCE OF SOLID RARE GASES EXCITED FROM ELECTRON BOMBARDMENT. Bonnot, A.; Bonnot, A. M.; Coletti, F.; Debever, J. M.; Hanus, J. (Aix-Univ., Marseille). J. Phys. (Paris), Colloq.; No. 3, 49-52(1974). (In French).

From colloquium on the optical properties of wide band gap semiconductors; Montpellier, France (5 Sep 1973).

The luminescence spectrum of the electron-excited solid rare gases was studied. The high-energy spectrum includes (1) very sharp lines close to the free exciton observed in reflectivity and

absorption experiments, and (2) one or two broad bands 1.5 eV below the excitonic lines. The sharp lines are due to the radiative decay of free or weakly trapped excitons, the broad bands are from molecular excitons made of an exciton self-trapped on a neighboring atom in its ground state. The 1 to 2 eV energy difference is accounted for by the binding energy of the molecular exciton and the final state repulsive energy of the two ground state atoms at a distance quite shorter than the equilibrium distance. (FR)

14993 PLURAL SAMPLE ION SOURCE. Wallington, M. J. (to Associated Electrical Industries Ltd.). US Patent 3,849,656. 19 Nov 1974. Priority Date 17 Dec 1968, United Kingdom of Great Britain and Northern Ireland. 6p.

An ion source for separately ionizing a plurality of vaporized samples and focusing the ions produced by the ionization into an ion beam containing ions from each of the vaporized samples is described. The ion source comprises an ionization chamber having an aperture through which ions are emitted, means for emitting an electron beam into the ionization chamber, at least one ion control electrode for establishing an ion control field, and partition means for dividing the ionization chamber into a first and second electron bombardment chamber. The ion source also includes a first and second gas storage vessel for respectively introducing at least a first and second vaporized sample into the first and second electron bombardment chambers, respectively, so that the first and second vaporized samples are independently ionized. (Official Gazette)

Atomic and Molecular Properties

Refer also to abstracts 14665, 15030, 15472, 15836, and 15892.

14994 (FEI-442) PROBABILITIES OF THE ENERGY-LEVEL TRANSITIONS BETWEEN THE CESIUM ATOM EXCITED STATES. Lebedev, M. A.; Cherkovets, V. E.; Yusim, S. V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1973. 58p. (In Russian). INIS.

The results of the calculation of the probability of transitions between excited states of the Cs atom, made on a computer, were reported. Different formulas (Born, Thomson, and Grizinsk) were used for the calculation of the cross section of the excited levels during the calculation of the transition probabilities. (tr-auth)

14995 (INIS-mf-1270) NON-ADDITIVE POTENTIAL IN THE He_3 SYSTEM. Gonzalez, T. L. (Instituto Politecnico Nacional, Mexico City. Escuela Superior de Fisica y Matematicas). 1973. 63p. (In Spanish). INIS.

Thesis.

The nonadditive energies of three bodies was calculated for different geometric configurations in one of the simplest systems, that formed by three He atoms. The basis was the Roothaan self-consistent field method with linear combinations of atomic orbitals for interatomic distances permitting overlapping. The POLYATOM program was used for the calculation. The calculations were first made for linear configurations in general. The nonadditive potential was also calculated for isosceles triangular configuration and for scalene triangles in general. The nonadditive effect found is most important for short interatomic distances where the electron overlapping is large. The effect is attractive for equilateral triangles and becomes repulsive to the extent that the triangular configuration becomes linear. (tr-auth)

14996 ENERGY SPECTRUM OF He I AND H^- IN A STRONG MAGNETIC FIELD. Surmelian, G. L.; Henry, R. J. W.; O'Connell, R. F. (Louisiana State Univ., Baton Rouge (USA). Dept. of Physics and Astronomy). Phys. Lett., A; 49: No. 6, 431-432 (21 Oct 1974).

The energy spectrum of He I is calculated by a variational method for magnetic fields B in the range 0 to 3×10^{11} gauss. Improved results for the electron affinity of H^- are also presented. (auth)

14997 STARK BROADENING AND DISPLACEMENT OF ISOLATED He I LINES. Diatta, C. S.; Fleurier, C.; Chapelle, J.; Sahal, S. (Centre National de la Recherche Scientifique, 45 - Orleans-la-Source (France). Centre de Recherches sur la Physique des Hautes Temperatures). Phys. Lett., A; 49: No. 6, 450-452(21 Oct 1974).

Experimental results for Stark-broadened He I lines emitted by a helium plasma jet ($N_e \sim 3 \times 10^{16}$ cm^{-3}) are compared with theory; agreement is good enough for widths, whereas shift calculations show generally large discrepancies with experimental data. (auth)

14998 AN OPTIMUM SET OF SEMI-EMPIRICAL VALUES FOR THE MAGNETIC SUSCEPTIBILITY AND RELATED QUANTITIES FOR MOLECULAR HYDROGEN. Walnut, T. H. (Syracuse Univ., N. Y. (USA). Dept. of Chemistry). Chem. Phys. Lett.; 29: No. 2, 230-231(15 Nov 1974).

A priori theoretical results are combined with the results of measurements of the magnetic susceptibility, the magnetic anisotropy and the high frequency part of the magnetic susceptibility of H_2 and D_2 to give the most accurate set of these quantities available. (auth)

14999 ABSOLUTE CROSS SECTIONS FOR EXCITATION OF THE 4S STATE OF HYDROGEN FROM COLLISIONS OF H^+ AND H^0 WITH He, Ar, N_2, O_2, AND CO_2. Kleckner, E. W. Seattle; Univ. of Washington (1974). 159p. University Microfilms Order No. 74-29,437.

Thesis (Ph. D.).

Absolute cross sections for excitation of the 4s state of hydrogen from collisions of H^+ and H^0 with He, Ar, N_2, O_2, and CO_2 are reported for a projectile energy range between 5 and 55 keV. These measurements employ a collision-free decay technique wherein the projectile beam interacts with a thin gas target and the radiation of the Balmer beta emission is studied as a function of distance downstream from the target exit, thus allowing a unique separation of 4s level excitation. Description of apparatus developed and built for this experiment includes accelerator, beam neutralization chamber, single photon detector, and bolometric detector. Independent absolute calibrations of the single photon detector and of the bolometric neutral atom detector are described and utilized. Of the new results presented, the cross sections for neutral excitation on Ar, O_2, and CO_2 indicate that direct excitation is the dominate contributor to 4s excitation at energies below 15 keV. The neutral excitation cross section on N_2 agrees well with that of another measurement. Results obtained using proton projectiles show reasonable agreement, when possible, with those of previous experimental investigations; and the absolute excitation cross section reported for CO_2 as a target gas is a new result. (Diss. Abstr. Int., B)

15000 THE CONTINUITY DILEMMA AND HARTREE-FOCK INSTABILITIES. Moiseyev, N.; Katriel, J. (Technion-Israel Inst. of Tech., Haifa). Chem. Phys. Lett.; 29: No. 1, 69-72 (1 Nov 1974).

The stability criteria of the Hartree-Fock wave functions are implemented in the context of the Roothaan-Hartree-Fock procedure. Use is made of modified SCF equations, in which the total energy, rather than orbital energies, appears. The procedure is applied to the 2^3S state of helium. (auth)

15001 USE OF OSCILLATOR FORCES OF SUPERSENSITIVE TRANSITIONS OF LANTHANIDE IONS FOR CALCULATING PARAMETERS THAT DETERMINE THE INTENSITY OF THEIR ABSORPTION SPECTRA. Poluektov, N. S.; Mishchenko, V. T. (Inst. of General and Inorganic Chemistry, Kiev). Teor. Eksp. Khim.; 10: No. 5, 681-684(1974). (In Russian).

Comparison of literature data on values of oscillator forces, P, of Nd^{3+} and Er^{3+} ion absorption bands corresponding to "supersensitive" transitions and values of the parameter τ_2 (basic component in the mathematical characteristic of the electrical field of the ligands in different compounds, showed a linear relation between τ_1 and P for all transitions analyzed. Values of τ_2 for various compounds of these lanthanides can be calculated from P. Values of τ_2 for Nd^{3+} correlate with those on Er^{3+}, Tu^{3+}, or Yb^{3+}, and τ_2 values for monotypic complexes of lanthanides can be uniquely determined from τ_2 values for other lanthanides. (tr-auth)

15002 DYNAMIC POLARIZABILITY OF HELIUM: A RANDOM PHASE APPROXIMATION CALCULATION. Linderberg, J.; Prato, D. (Aarhus Univ., Denmark). Int. J. Quant. Chem.; 8: No. 6, 901-913(Nov 1974).

The random phase approximation (RPA) or time-dependent Hartree–Fock approximation (TDHF) is reconsidered for the calculation of the dynamic polarizability for atoms. An integral equation which admits a simple numerical treatment is established. The asymptotic approximation for the electron propagator is tested for its applicability by means of comparisons with earlier results. (auth)

15003 ERROR ANALYSIS OF VARIATIONALLY OPTIMIZED UPPER- AND LOWER-BOUND WAVE FUNCTIONS FOR H_2^+. Ley, B. E.; Thorpe, T.; Rothstein, S. M. (Brock Univ., St. Catharines, Ont.). Int. J. Quant. Chem.; 8: No. 6, 971-980(Nov 1974).

Wave functions which are a linear combination of H_2^+-type elliptical orbitals are optimized to provide either an upper bound or a

lower bound to the H_2^+ ground state. For the latter, Temple's formula is used. Three criteria are considered to determine the relative accuracy of these wave functions: (i) energy (calculated versus exact eigenvalue); (ii) average error; and (iii) local energy. Although the lower-bound optimized wave functions obtained are the most accurate available for H_2^+ from approximate wave functions, they are still inferior to the corresponding upper-bound wave functions by criteria (i) and (ii). In particular, using criterion (ii), it is shown numerically that the upper-bound functions are "correct to second order," while the lower-bound functions are almost, but not quite, "correct to second order." Despite this, the local energy analysis, criterion (iii), reveals that the lower-bound wave functions can be more accurate than the upper-bound functions in some regions of space, and hence give more accurate values for physical properties sensitive to these regions. Examples considered are the dipole-dipole and Fermi contact interactions. (auth)

Positronium, Muonium, and Muonic and Mesic Atoms and Molecules

Refer also to abstracts 15052, 15472, and 15485.

15004 MEASUREMENT OF KAONIC X-RAYS FROM Al, Si, Ni AND Cu. Barnes, P. D.; Eisenstein, R. A.; Lam, W. C.; Miller, J.; Sutton, R. B. (Carnegie-Mellon Univ., Pittsburgh, Pa. (USA)); Eckhause, M.; Kane, J. R.; Welsh, R. E. (College of William and Mary, Williamsburg, Va. (USA)); Jenkins, D. A.; Powers, R. J. Nucl. Phys., A; 231: No. 3, 477-492(21 Oct 1974).

The x-rays associated with stopped negative kaons in Al, Si, Ni and Cu have been identified. Relative intensities, strong-interaction energy shifts and strong-interaction line broadening are reported. The measurements are found to be in good agreement with those predicted on the basis of a simple phenomenological potential except for the Ni (5 → 4) transition width. (auth)

15005 EVIDENCE FOR FORMATION OF THE FIRST EXCITED STATE OF POSITRONIUM. Varghese, S. L.; Ensberg, E. S.; Hughes, V. W.; Lindgren, L. (Yale Univ., New Haven, Conn. (USA). Gibbs Lab.). Phys. Lett., A; 49: No. 6, 415-417(21 Oct 1974).

Study of the n = 2 state of positronium (Ps), in particular, measurement of the fine structure intervals including the Lamb shift and comparison with the theoretical calculations, would provide an important test of quantum electrodynamics. Evidence based on positronium 2γ annihilation radiation is reported for the formation of the n = 2 state of positronium in a gas by optical excitation from the n = 1 state. (auth)

15006 MUONIC AND PIONIC L- AND M-SERIES IN CARBON AND OXYGEN AND THE PIONIC 2p LEVEL SHIFT AND WIDTH OF OXYGEN. von Egidy, T.; Povel, H. P. (European Organization for Nuclear Research, Geneva (Switzerland)). Nucl. Phys., A; 232: No. 2, 511-518(4 Nov 1974).

Muonic and pionic x-rays of the L- and M-series in C and O were measured with a Si(Li) detector in the energy range between 7 keV and 60 keV. The target consisted of mylar ($C_5H_4O_2$). Energies and intensities of 21 transitions were determined. The strong interaction shift of the pionic 2p level in O was measured and found to be +4.1 ± 2.3 eV. The measured width of this level is 11 ± 6 eV. The measured yields were compared with cascade calculations. (auth)

15007 PIONIC AND MUONIC X-RAY TRANSITIONS IN LIQUID HELIUM. Backenstoss, G.; Egger, J.; von Egidy, T.; Hagelberg, R.; Herrlander, C. J.; Koch, H.; Povel, H. P.; Schwitter, A.; Tauscher, L. (European Organization for Nuclear Research, Geneva (Switzerland)). Nucl. Phys., A; 232: No. 2, 519-532 (4 Nov 1974).

Energies and intensities of pionic and muonic x-rays in liquid ^{4}He were measured with a Si(Li) detector. The energy shift due to strong interaction effects of the pionic 1s level in ^{4}He was determined to be −75.7 ± 2.0 eV. The natural line width of this level is 45 ± 3 eV. These values are compared with different theoretical predictions. Cascade calculations, including external Auger effect and sliding transitions, were performed to reproduce the yields of the muonic and pionic transitions. The pionic 2p level width is deduced: $\Gamma_{2p} = (1.1 \pm 0.5) \times 10^{12}$ sec^{-1} ≙ (7.2 ± 3.3) × 10^{-4} eV. (auth)

15008 CALCULATION OF THE FIRST RADIATIVE CORRECTIONS TO THE LIFETIME OF ORTHOPOSITRONIUM. Stroscio, M. A. New Haven; Yale Univ. (1974). 114p. University Microfilms Order No. 74-26,343.

Thesis (Ph. D.).

The calculation of the first radiative corrections to the lifetime of orthopositronium is reported. This calculation is especially relevant since recent experimental work is sensitive to these corrections. The techniques of quantum electrodynamics are used to calculate the contribution of the basic decay process and the contribution of the first radiative corrections to the lifetime of orthopositronium. The inverse of the lifetime of orthopositronium due to the basic decay process is $(1/\tau)_0 = (0.72112 \pm 0.00001) \times 10^7$ sec^{-1}. Upon including the contribution of the first radiative corrections, which is the new result reported, the inverse of the lifetime is given by $(1/\tau) = (0.7241 \pm 0.0010) \times 10^7$ sec^{-1}. (Diss. Abstr. Int., B)

15009 SOLVATED POSITRON CHEMISTRY. The Reaction of Hydrated Positrons with Chloride Ions. Mogensen, O. E.; Shantarovich, V. P. (Danish Atomic Energy Commission, Risoe, Research Establishment). Chem. Phys. (Amsterdam); 6: No. 1, 100-108(Oct 1974).

The reaction of hydrated positrons (e^+_{aq}) with chloride ions in aqueous solutions was studied by means of positron annihilation angular correlation measurements. A rate constant of k = (2.5 ± 0.5) × 10^{10} M^{-1} s^{-1} was found. Probably the reacting positrons annihilated from an e^+Cl^- bound state resulting in an angular correlation curve 8% narrower than for the hydrated positron. Carbon tetrachloride in benzene seems to give a similar, but smaller effect. (auth)

15010 MU-ATOMIC X-RAY SERIES IN LITHIUM AND LITHIUM HYDRIDE. Konin, A. D.; Pokrovsky, V. N.; Ponomarev, L. I.; Schneuwly, H.; Zinov, V. G.; Yutlandov, I. A. (Joint Inst. for Nuclear Research, Dubna (USSR)). Phys. Lett., A; 50: No. 1, 57-58(4 Nov 1974).

The relative intensities of muonic X-rays in metallic Li and LiH targets have been measured. The comparison of experimental results with theoretical estimates suggests the population of levels with low l to be favored during the initial phase of atomic capture of muons. (auth)

15011 INFLUENCE OF BOND IONICITY AND ACID PROPERTIES OF HYDROGENOUS COMPOUNDS ON π^--MESON CAPTURE BY HYDROGEN. Gol'danskij, V. I.; Zatsepina, N. N.; Petrukhin, V. I.; Risin, V. E.; Suvorov, V. M.; Tupitsyn, I. F.; Kholodov, N. I.; Yutlandov, I. A. Dokl. Akad. Nauk SSSR; 214: No. 6, 1337-1339(21 Feb 1974). (In Russian).

For English translation see the journal Dokl. Phys. Chem.

An attempt was made to obtain the quantitative relation between the experimental values of the α_{H-Z} coefficient and some physical chemical values depending on the properties of the electron shell of the hydrogen atoms in molecules of different organic and inorganic compounds. The capture probability W for π mesons by hydrogen nuclei was measured on the synchrocyclotron of the Laboratory of Nuclear Problems. The values obtained for a series of compounds are tabulated. (INIS)

15012 E2 NUCLEAR RESONANCE EFFECT IN PIONIC ATOMS. Leon, M. (Los Alamos Scientific Lab., N. Mex. (USA)). Phys. Lett., B; 53: No. 2, 141-142(25 Nov 1974).

The quadrupole nuclear resonance effect in pionic atoms is considered, and the results of calculations for pionic atoms with distorted even-even nuclei are presented. (auth)

15013 EVIDENCE FOR FORMATION OF THE FIRST EXCITED STATE OF POSITRONIUM. Varghese, S. L. New Haven; Yale Univ. (1974). 173p. University Microfilms Order No. 74-26,353.

Thesis (Ph. D.).

Positronium, the bound atomic system of an electron and a positron, provides an excellent testing ground for the theory of quantum electrodynamics since no particles alien to the theory are present. While there has been good agreement between theory and experiment in the ground state, various attempts aimed at detecting the n = 2 state have been unsuccessful. An experiment to produce the n = 2 state of positronium by optical excitation from the ground state is reported. The result of the experiment is interpreted as evidence for formation of the n = 2 state of positronium. In conclusion; the research presented showed that, indeed the first excited state of positronium was produced and detected. (Diss. Abstr. Int., B)

Collision Phenomena

Refer also to abstracts 13608, 14999, and 15295.

15014 (COO-2130-119) HEAVY ION LECTURE SERIES. Volume I. Bromley, D. A.; Merzbacher, E.; Robson, D.;

Saris, F. (Kansas State Univ., Manhattan (USA)). 1973. Contract AT(11-1)-2130. 393p. Dep. NTIS $22.75.

Separate abstracts were prepared for each of the fourteen lectures in this report. (RWR)

For abstracts of individual papers see: 13608, 15015–15020, 15033, 15295, 15322–15324, 15367, and 15504.

15015 (COO-2130-119, pp 144-167) THEORIES OF INELASTIC COLLISIONS. Merzbacher, E. 1973.

In heavy ion lecture series. Volume I.

The plane-wave Born-approximation formula for the cross section for producing a hole in the K shell is exhibited, and the universality of the formula is discussed and compared with experimental data at various energies. The applicability of hydrogenic wave functions for heavier atoms is addressed; and it is found that something better, such as Hartree–Fock-type wave functions, is required. Then the question of whether the cross section for the various subshells in the L shell behave differently is examined. Finally, the relation between the semiclassical approximation, the plane-wave Born approximation, and the binary encounter approximation is discussed. (10 figures) (RWR)

15016 (COO-2130-119, pp 168-186) ENERGY LOSS PROBLEMS. Merzbacher, E. 1973.

In heavy ion lecture series. Volume I.

In first-order perturbation theory all inelastic cross sections are proportional to Z_1^2. It has been found, however, that inelastic atomic processes are not proportional to the square of the charge of the incident particle. Departures from the Z_1^2 law are discussed in this lecture. The energy loss under consideration is the inelastic energy transfer to the electrons in the atom; the so-called nuclear contribution is not taken into account. The energy loss is given by simply taking the cross section for going from the initial state of the atom to some state n′, then multiplying that by the energy transfer and summing over all n′. Formulas such as the Bethe–Bloch relation do well for most electrons, but they do not accurately represent the energy loss to the inner electrons. A calculation leading to a Z^3 correction is described; this is a polarization effect, presumably important at "lowish" velocities. An important advantage of a method which treats the dipole interaction exactly is that the calculation is appropriate for heavy ions. (RWR)

15017 (COO-2130-119, pp 187-206) MULTIPLE EXCITATION AND OTHER HIGHER ORDER PROCESSES. Merzbacher, E. 1973.

In heavy ion lecture series. Volume I.

This lecture begins with some remarks about the Z_1 dependence of inner-shell vacancy production, including a discussion of some recent data from an experiment measuring coincidences between x rays and scattered ions. Then attention is turned to multiple ionization, multiple excitation, and small impact parameters. The probability for exciting both a K-shell electron and an L-shell electron is discussed in the semiclassical approximation. (1 figure) (RWR)

15018 (COO-2130-119, pp 277-307) ION-INDUCED X RAYS, THE MOLECULAR ASPECT. Saris, F. 1973.

In heavy ion lecture series. Volume I.

Measurements of x-ray emission cross sections of heavy-ion–atom collisions are described, and the following conclusions are reached: there is a large difference in excitation or ionization mechanism between heavy ions and protons; resonances occur in a plot of cross sections vs Z, and they occur at those Z's where the binding energies of the two colliding particles match; in a collision between particles of unequal Z, the lower-Z inner shell is excited with greater probability than the higher-Z; all x-ray lines induced by heavy ions are greatly shifted with respect to lines produced by protons or helium. The molecular electron-promotion model was devised to explain these data. In conclusion, the topic of fluorescence yield is addressed. (25 figures) (RWR)

15019 (COO-2130-119, pp 308-328) SOLID EFFECTS ON INNER-SHELL IONIZATION. Saris, F. 1973.

In heavy ion lecture series. Volume I.

The special effects produced by solid targets in ion–atom collisions are discussed. The emphasis is on projectile x rays. It is found that, in comparing gas targets with solid targets, there are big differences observed in the spectra that reflect differences in charge states. Double vacancies are more likely to be created with solid targets than with gas targets. Excitation occurs inside a solid which does not happen with a gas target. (16 figures) (RWR)

15020 (COO-2130-119, pp 329-350) X-RAY STUDIES OF THE CHARGE STATE OF IONS IN A SOLID. Saris, F. 1973.

In heavy ion lecture series. Volume I.

The success of the molecular model in predicting and explaining x-ray results leads to the question as to whether one could actually observe the molecular states predicted to exist during the collision; one would have to observe a radiative or Auger transition between two of those molecular orbitals. Data are exhibited which show that such transitions are indeed observed. These molecular x rays can lead to better understanding of collision processes such as transfer of vacancies from one orbital to another, as well as recoil-induced effects. One can get quantitative information on the shape of the molecular orbitals and map the molecular orbital on the energy-level diagram. Finally, they may allow study of the energy levels of superheavy quasi atoms. (11 figures) (RWR)

15021 (COO-3235-51) ARRANGEMENT CHANNEL QUANTUM MECHANICS: A GENERAL TIME DEPENDENT FORMALISM FOR MULTIPARTICLE SYSTEMS. Kouri, D. J.; Krueger, H.; Levin, F. S. (Max-Planck-Institut fuer Stroemungsforschung, Goettingen (F. R. Germany); Trier-Kaiserslautern Univ., Kaiserslautern (F. R. Germany). Fachbereich Physik; Brown Univ., Providence, R. I. (USA). Dept. of Physics). 1974. Contract AT(11-1)-3235. 36p. Dep. NTIS $5.00.

A new time-dependent quantum mechanical formulation of the multichannel scattering problem is set up which takes explicit account of each separate arrangement channel. Such a formulation avoids the usual difficulties connected with the nonorthogonality of state vectors in different arrangements. It further leads in a natural way to the definition and explicit realization of a super-scattering operator as well as similar super-transition and Møller operators. Moreover this super-scattering operator is found to be the strong limit of the evolution operator in a generalized interaction picture. After projecting onto the channel arrangement basis vectors, these super-operators lead to matrices of more familiar channel arrangement operators, e.g., channel T operators in the case of the super T operator. As an example of the considerable formal simplification resulting in the present approach, the problem of constructing orthogonal projection operators is discussed briefly: The method is also shown to yield simple approximation schemes for the general n-body scattering problem. (auth)

15022 (PUC-TN-5/74) ELECTRON EXCITATION IN NOBLE GASES. de Barros, H. G. P. L.; Brandi, H. S. (Pontificia Universidade Catolica do Rio de Janeiro (Brazil). Instituto de Fisica). May 1974. 31p. INIS.

Calculations for excitation cross sections for some states of Ne by electron impact were carried out. A parametrization of total and differential cross section in the Born-Ochkur approximation was proposed. Using this parametrization and appropriate wave functions for the states involved in the collision processes, differential and total cross sections were calculated. The results showed that this parametrization is very convenient to study this class of problems. (auth)

15023 (UCRL-76013) X-RAY PRODUCTION IN HEAVY ION–ATOM COLLISIONS: $4f\sigma$ ELECTRON PROMOTION. Fortner, R. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Oct. 1974. 18p. (CONF-741040-12). Dep. NTIS $4.00.

From third conference on the use of small accelerators; Denton, Texas, USA (21 Oct 1974).

A systematic study of x-ray production in ion-atom collisions is presented for electron promotion by $4f\sigma$ molecular orbitals. L x-ray production cross sections are presented for P^+, S^+, Cl^+, Ar^+ and K^+ projectiles incident on Ar gas targets for projectile energies between 15 and 200 keV. In addition, high resolution L x-ray spectral measurements for $Ar^+ \rightarrow Ar$ collisions are presented. Average values of the fluorescence yield and total L-shell ionization cross sections are determined. A dramatic Z dependence observed in the x-ray production cross section is attributed to changes in fluorescence yield. New theoretical calculations of argon L fluorescence yield are found to be in reasonable agreement with the experiment for the $Ar^+ \rightarrow Ar$ case. (auth)

15024 CHARGE EXCHANGE CROSS SECTIONS FOR He^+ INCIDENT ON Cs. Meyer, F. W.; Anderson, L. W. (Wisconsin Univ., Madison (USA). Dept. of Physics). Phys. Lett., A; 49: No. 6, 441–442(21 Oct 1974).

The total charge-exchange cross section, σ_{+0}, for He^+ incident on Cs vapor has been measured in the energy range 0.5 to 41 keV. The cross section falls from $(1664 \pm 100) \times 10^{-17}$ cm^2 at 1.4 keV to $(224 \pm 20) \times 10^{-17}$ cm^2 at 41 keV. These measurements are compared with previous measurements and with theoretical calculations of this cross section. (auth)

15025 DESTRUCTION OF FAST HYDROGEN ATOMS IN THE 2s STATE BY COLLISION WITH H_2, He, N_2, AND Ar. Berge, P. O. Fayetteville, AR; Univ. of Arkansas (1974). 65p. University Microfilms Order No. 74-28,047.

Thesis (Ph. D.).

Absolute cross sections were measured for the destruction of fast hydrogen atoms in the metastable 2s state by collision with H_2, He, N_2, and Ar gas targets in the 20 to 120 keV energy range. For He, the measured values agree within experimental error with the destruction mechanism postulated by Hughes and Kisner in which the proton and the electron in the fast atom are considered as two separate particles. For N_2, H_2, and Ar, the additional process of de-excitation also appears to be important. (Diss. Abstr. Int., B)

15026 INFRARED EMISSION SPECTRA OF N_2 AND N_2^+ BY ELECTRON IMPACT EXCITATION. Mandelbaum, D. Baltimore; Johns Hopkins Univ. (1974). 134p. University Microfilms Order No. 74-29,014.

Thesis (Ph. D.).

The relative cross sections for excitation by electron impact on N_2 were measured for the infrared bands of the Meinel system ($A^2\Pi_u - X^2\Sigma_g^+$) of N_2^+ and for the first positive system ($B^3\Pi_g - A^3\Sigma_u^+$) of N_2 in the region between .8 μm and 1.6 μm. The effect of the helium buffer on the intensity of the Meinel bands was described. A synthetic spectrum of the nitrogen emissions in the infrared region was obtained and used in the identification of some of the bands produced. The electronic transition moment $Re(\bar{r})$ and its variation with respect to internuclear distance was determined for the two emission systems described above. A synthetic band profile of the (1-0) Meinel band is used to estimate the rotational temperature of a nitrogen gas. A search for the (7-2) band of the $W^3\Delta_u$ to $B^3\Pi_g$ transition was attempted with the result that an upper limit was obtained for the excitation cross section to the $v' = 7$ level. A method to improve the identification of the (7-2) band is described. Data for dissociative excitation of N_2 was obtained from the emission of atomic multiplets in the infrared region, and relative cross sections for dissociative excitation were measured. (Diss. Abstr. Int., B)

15027 QUASIMOLECULAR K X-RAY EXCITATION BY BOMBARDMENT OF Ge ATOMS WITH Ge IONS. Gippner, P.; Kaun, K. H.; Stary, F.; Schulze, W.; Tretyakov, Yu. P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). Nucl. Phys., A; 230: No. 3, 509-514(30 Sep 1974).

By bombardment of Ge targets with $^{74}_{32}Ge^{5+}$ of 81 MeV, a continuous X-ray intensity distribution has been obtained which ranges up to the K X-ray energies of $_{64}Gd$. The shape of the spectra, corrected for the detector efficiency, confirms the assumption that this continuum is caused by K X-rays of $Z = 64$ quasimolecules, which are transiently formed during the adiabatic heavy-ion collision. The yield of quasimolecular radiation was determined to be about 4×10^{-5} X-rays per beam K vacancy. (auth)

15028 A QUANTUM-MECHANICAL NORMAL-MODE APPROACH TO COLLINEAR COLLISIONS OF IDENTICAL DIATOMICS. Distorted Wave Formulation. Bergeron, G.; Chapuisat, X. (Paris-11 Univ., 91 - Orsay (France)). Chem. Phys. Lett.; 29: No. 1, 77-88(1 Nov 1974).

A purely quantum mechanical description of the collinear collision of two identical diatomics is presented within a normal-mode decomposition technique previously used semiclassically by Zelechow et al. The model is shown to extend considerably the range of validity of the distorted wave approximation. The results are discussed and compared to the previous semiclassical results. (auth)

15029 ASSOCIATIVE IONIZATION OF Ti, Zr, Gd, AND Th IN COLLISIONS WITH O AND O_2. Lo, H. H.; Fite, W. L. (Extranuclear Laboratories, Inc., Pittsburgh, Pennsylvania, USA). Chem. Phys. Lett.; 29: No. 1, 39-41(1 Nov 1974).

Associative ionization cross sections for Ti, Zr, Gd, and Th with O and for Th with O_2 were measured using a crossed beam technique. Known associative ionization cross sections for U + O and U + O_2 were used for normalization of results. (auth)

15030 CROSS SECTIONS FOR STRIPPING AND ELECTRON ATTACHMENT OF HYDROGEN ATOMS IN THE METASTABLE STATE AND GROUND STATE IN COLLISION WITH HYDROGEN IODIDE. Pradel, P.; Roussel, F. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Atomique). Nucl. Instrum. Methods; 121: No. 1, 111-117 (1 Oct 1974).

Collisions of ground state (1S) and metastable (2S) H atoms in an HI target have been studied in the energy range 0.5–3.0 keV. The total cross section for collisional destruction of H(2S) in HI is found to be about 3×10^{-15} cm^2 in this energy range. For an acceptance half-angle of 10 mrad, the electron attachment and stripping cross sections of both H(1S) and H(2S) have been measured. The ratio of the electron stripping cross section for H(2S) relative to H(1S) is found to be large at low energy. Thus HI could serve as a selective charge-exchange medium for the production of polarized protons in sources of the Lamb-shift type. (auth)

15031 ROTATIONAL EXCITATION OF HD BY COLLISIONS WITH He. Green, S. (Columbia Univ., New York (USA). Dept. of Chemistry). Physica; 76: No. 3, 609-615(1974).

It is shown that the interaction potential recently derived for H_2-He is also consistent with sound absorption and NMR spin-lattice relaxation measurements on HD. Based on this potential, collision-induced pressure broadening coefficients and also rate constants for rotational excitation are predicted. The latter may be important for understanding cooling processes in the interstellar medium. (auth)

15032 DESTRUCTION OF METASTABLE HYDROGEN ATOMS IN COLLISIONS WITH HELIUM. Pradel, P.; Roussel, F.; Schlachter, A. S.; Spiess, G.; Valance, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Atomique). Phys. Lett., A; 50: No. 1, 3-4(4 Nov 1974).

The collisional destruction cross section for hydrogen atoms in the metastable 2s state in passage through helium has been measured in the energy range 0.075–3.0 keV. Results are in relatively good agreement with previous calculations. (auth)

Atomic Theory

15033 (COO-2130-119, pp 124-143) INTRODUCTION TO THE THEORY OF INNER SHELL IONIZATION. Merzbacher, E. 1973.

In heavy ion lecture series. Volume I.

The primary topic of this lecture is Coulomb excitation, in which a charged particle sweeps by an atom and interacts with a single electron directly; it is discussed in terms of first-order perturbation theory, the Born approximation. The results of the theoretical development are compared with experiment. (5 figures) (RWR)

15034 (INIS-mf-1396) COLLECTIVE EXCITATIONS IN ATOMS. Kok, F. J. (Rand Afrikaans Univ., Johannesburg (South Africa)). Jul 1972. F1-F9p. (In Afrikaans). INIS.

From seventh annual seminar on theoretical physics; Johannesburg, S. Afr. (3 Jul 1972).

The collective motion of the electron cloud in atoms is investigated by using a Tamm-Dancoff approximation. An average electron potential is constructed and electron–hole matrix elements are estimated. The eigenvalue problem is reduced to that of the schematic model used in nuclear physics. Contributions of the electron continuum are also included; for xenon the collective state energy is estimated to be 100 eV. (auth)

15035 ELECTRONIC CORRELATION STUDIES. II. Self-Correlated Field Method. Application to Ground State and First ^1P, ^3P Excited States of Two-Electron Atomic Systems. Guerillot, G. R.; Lissillour, R. (Univ. Rennes, France). Int. J. Quant. Chem.; 8: No. 6, 825-838(Nov 1974).

An antisymmetric pair function can be built upon two kinds of monoelectronic functions, the former ones being correlated local functions and the second ones nonlocal functions taking external effects into account. This function, brought into the generalized product function procedure by means of the density matrix formulation, makes possible the study of correlation within N-electronic systems. The results of a first application of this method to the fundamental and to ^1P and ^3P excited states of two-electron systems are given. (auth)

15036 SPIN-PROJECTED EXTENDED HARTREE–FOCK EQUATIONS. II. Odd-Electron Systems. Mayer, I. (Central Research Inst. for Chemistry, Budapest). Int. J. Quant. Chem.; 8: No. 6, 893-899(Nov 1974).

The spin-projected extended Hartree–Fock equations discussed for an even number of electrons are given for the odd-electron case. (auth)

15037 DENSITY MATRICES AND THE ATOMIC STRUCTURE PROBLEM. Fusco, M. A. Davis, CA; Univ. of California (1974). 106p. University Microfilms Order No. 74-29,310.

Thesis (Ph. D.).

A partial solution to the N-representability problem exists in the form of nonnegativity conditions on certain matrices which depend functionally on Γ and on Γ itself. These are the hole-hole matrix Q and the particle-hole matrix G. It was decided to carry out a

variational calculation using these conditions to see if they were effective in preventing the above-mentioned inconsistencies. The test system chosen was the beryllium atom. Because of the insufficiency of the N-representability conditions used it is anticipated that the method gives a lower bound to the energy obtainable with a configuration interaction calculation using the same number of single particle states instead of an upper bound as is usual with variational calculations. Results indicate that variational calculations over classes of density matrices are feasible and that by taking into account the known conditions it is possible to improve on the Hartree–Fock result while at the same time avoiding the complexity of a configuration interaction calculation. The conditions used prevent a runaway solution to infinitely negative energies so effectively as to give an energy of −14.61425 au, well above the experimental value of −14.66745 au and practically identical to the energy obtained with a CI calculation using the same states. Then a systematic study was carried out on the effects produced in the value of the energy and in the occupation numbers of the natural spin orbitals and natural germinals by a gradual weakening of the nonnegativity conditions on each of the matrices in turn, then on pairs of them, and finally on all three of them. It was found that the nonnegativity condition on any one matrix could be relaxed without appreciably lowering the energy, while a simultaneous weakening of the condition on Q and G gave a spectacular drop in the energy. An examination of the changes in the eigenvalues of these matrices as the constraint was weakened led to the same conclusion, namely, that the constraint on the pair Q and G was most important. The expected dynamical correlations introduced by the two-body part of the Hamiltonian were obtained. (Diss. Abstr. Int., B)

PHYSICS (ELECTROFLUID AND MAGNETOFLUID)

15038 (AD-782002) ROTATIONAL MOTION OF AN ELECTROCONDUCTIVE FLUID BETWEEN FINITE-SIZE DISKS IN CROSSED ELECTRIC AND MAGNETIC FIELDS. Gorbachev, L. P.; Molashenko, V. S.; Potanin, E. P. Translated from Magn. Gidrodin.; No. 3, 91-94(16 Apr 1974). 9p. (FSTC-HT-23-1850-73). NTIS $4.00.

Axisymmetric rotational motion of an electroconductive fluid between dielectric disks of finite radius acted on by crossed electric and axial magnetic fields in the presence of boundary layers is examined. (GRA)

15039 HEAT TRANSFER IN MAGNETOHYDRODYNAMIC LAMINAR RADIAL CHANNEL FLOW. Khader, M. S.; Vachon, R. I. (Auburn Univ., Ala. (USA). Dept. of Mechanical Engineering). Appl. Sci. Res. (The Hague); 29: No. 5, 321-341(Sep 1974).

Heat transfer in the steady axisymmetrical laminar source flow of an incompressible electrically conducting fluid between two parallel disks in the presence of a transverse applied magnetic field is analyzed. The energy equation is solved numerically for the temperature distribution, where both Joulean and viscous heating are included. Both local and average Nusselt numbers for the case of constant wall temperature are evaluated. For fluids of moderate and high Prandtl numbers, Nusselt number is seen to be a strong function of both Hartmann number and a heat generation parameter together with a modified Peclet number. However, for fluids of small Prandtl number, Joulean heating and viscous dissipation can be neglected without appreciable error. (auth)

15040 DISSIPATIVE EFFECT ON CONVECTIVE MHD CHANNEL FLOW. Yang, H. K.; Yu, C. P. (State Univ. of New York, Buffalo (USA)). Appl. Sci. Res. (The Hague); 29: No. 4, 297-304 (Aug 1974).

By means of a numerical analysis viscous and Joulean dissipations are considered in a combined forced and free convective MHD flow between two vertical plates that are subjected simultaneously to a pressure and a temperature gradient. It is shown that the dissipations tend to increase the flow rate and decrease the heat transfer, and they destabilize the system when the high temperature is at the lower side. (auth)

PHYSICS (HIGH-ENERGY)

Particle Interactions and Properties (Experimental)

Refer also to abstracts 14726, 15110, and 15476.

15041 (FERMILAB-Conf-74/74) REVIEW OF SOME RECENT EXPERIMENTAL RESULTS FROM FERMILAB. Einhorn, M. B. (Fermi National Accelerator Lab., Batavia, Ill. (USA)). Jul 1974. 56p. (CONF-740653-7). Dep. NTIS $6.00.

From 9th symposium on particle physics; Balatonfured, Hungary (12 Jun 1974).

A review of some recently available (mostly preliminary) data from Fermilab is presented. Four general areas are covered: particle searches, deep inelastic muon scattering, inelastic diffraction scattering, and the production of hadrons, muons, and electrons at large transverse momenta. The purpose is to give some overview of what has been and is being done in these areas, so progress reports are given on relevant experiments which do not yet have data to present. (auth)

15042 (NR-1421/VI/PH, pp 254-272) CERN INTERSECTING STORAGE RINGS: TECHNIQUE AND PHYSICS. Minten, A. (CERN, Geneva). 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

The status and prospects of proton storage rings, experimental technique, experiments, and the future outlook are discussed. (JFP)

15043 PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON HIGH ENERGY PHYSICS, TOKYO, JAPAN, JULY 23–27, 1973. Hara, Y. (ed.). Tokyo; Tokyo University (1973). 646p. (CONF-730731-).

Separate abstracts were prepared for each of the 36 papers included. (JFP)

For abstracts of individual papers see: 14730, 15053, 15075–15078, 15103–15106, 15130, 15161–15163, 15171, 15172, 15192–15200, 15211–15213, 15238–15240, 15259, 15260, 15263, 15606, 15607.

Electromagnetic

Refer also to abstracts 14788 and 14797.

15044 ON THE POSSIBLE EXISTENCE OF A VECTOR MESON $\rho'(1250)$. Conversi, M.; Paoluzi, L.; Ceradini, F.; D'Angelo, S.; Ferrer, M. L.; Santonico, R. (Rome Univ. (Italy). Istituto di Fisica); Grilli, M.; Spillantini, P.; Valente, V. (Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati). Phys. Lett., B; 52: No. 4, 493-497(28 Oct 1974).

By combining new results obtained at C.M. energies of 1.2 and 1.3 GeV with previous data obtained at lower energies from the e^+e^- annihilation process $e^+e^- \to \pi^+\pi^-\pi^0\pi^0$, an indication is obtained in favor of the existence of a new vector meson of the ρ type, ρ' (1250), the first daughter of the ρ in the predictions of the Veneziano model. Further results on the annihilation process $e^+e^- \to \rho''(1600) \to \pi^+\pi^-\pi^+\pi^-$ are also presented. (auth)

15045 $\Delta^{++}\pi^-$-ELECTROPRODUCTION NEAR THRESHOLD AND THE Q^2 DEPENDENCE OF THE CONTACT INTERACTION. Joos, P.; Ladage, A.; Meyer, H.; Notz, D.; Stein, P.; Wolf, G.; Yellin, S. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)); Benz, C.; Drews, G.; Hoffmann, D. Phys. Lett., B; 52: No. 4, 481-484(28 Oct 1974).

The Q^2 dependence of $\sigma(\gamma_v p \to \pi^-\Delta^{++})$ was measured. Close to threshold $\sigma(\gamma_v p \to \pi^-\Delta^{++})$ is roughly proportional to $1/(m_\rho^2 + Q^2)^2$. The data are consistent with dominance of the contact term and imply that the contact term has the Q^2 dependence of the ρ propagator. (auth)

15046 TWO-PHOTON EXCHANGE IN DEEP INELASTIC SCATTERING. Joestlein, H.; Kim, I. J.; Koenigsman, K.; Melissinos, A. C.; Muehlemann, P. (Rochester Univ., N. Y. (USA)); Aslanides, E.; Limon, P. (Columbia Univ., New York (USA)). Phys. Lett., B; 52: No. 4, 485-488(28 Oct 1974).

The contribution of the two-photon exchange amplitude has been measured in deep inelastic muon–nucleon scattering. It is found, with 95% confidence, that the real part of this amplitude is less than 0.017 of the one photon-exchange amplitude. The range of the 4-momentum transfer covered is $0.5 < Q^2 < 2.1$ (GeV/c)^2. (auth)

15047 PHOTOPRODUCTION OF $\pi\Delta(1236)$ FROM PROTONS BELOW 1.1 GeV. Fukui, S.; Inagaki, Y.; Iwata, S.; Kusumegi, A.; Mishina, M.; Miyachi, T.; Murata, Y.; Ohska, T.; Sasaki, A.; Sato, I. (Tokyo Univ. (Japan)). Nucl. Phys., B; 81: No. 3, 378-396(11 Nov 1974).

The π^+ and π^- momentum spectra of the reaction $\gamma p \to \pi\pi N$ have been measured at lab angles 20°, 40°, 60° and 90° and photon energies 0.744, 0.844, 0.944 and 1.044 GeV with a magnetic spectrometer using the photon subtraction method. Both spectra show a peak corresponding to the production of the $\pi\Delta(1236)$ state. The analysis has been carried out with amplitudes for the quasi two-body process $\gamma p \to \pi\Delta(1236)$ and a phase-space background so as to reproduce both π^+ and π^- spectra. The ratio of cross sections $\sigma(\gamma p \to \pi^+\Delta^0)/(\gamma p \to \pi^-\Delta^{++})$ is found to vary from 0.0 to 1.8, depending on kinematical conditions. (auth)

Weak

15048 (IFVE-SPK-73-54) POSSIBILITIES OF SEARCH OF W-BOSON AND PROCESS OF CHARGED LEPTON PAIR PRODUCTION IN NEUTRINO EXPERIMENT AT BUBBLE CHAMBER SKAT. Kuznetsov, E. P.; Makeev, V. V.; Sokolov, A. A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 24p. (In Russian). INIS.

The possibility of searching for the W boson and for processes of direct production of lepton pairs in neutrino experiments on the SKAT bubble chamber is examined. An analysis was made of the background conditions, and it was shown that the reaction for the production of W bosons with decay by the lepton channel can be identified with a high degree of certainty in the mass interval for W bosons of $m_W \lesssim 6$ GeV. (tr-auth)

15049 MEASUREMENTS OF THE BETA-DECAY PROPERTIES OF THE Λ HYPERON. Katz, C. N. College Park, MD; Univ. of Maryland (1973). 171p. University Microfilms Order No. 74-29,078.

Thesis (Ph. D.).

There were 1075 lambda beta decay events, $\Lambda \to pe\bar{\nu}e$, detected in a sample of approximately 1.1×10^6 charged lambda decays produced by a beam of K^- mesons stopping in the 30″ hydrogen bubble chamber at the Brookhaven National Laboratory AGS. For the branching ratio of the $\Lambda\beta$-decay mode the value $(0.82 \pm 0.04) \times 10^{-3}$ was found. For the value of the ratio of the axial vector form factor to the vector form factor used in describing the V-A hadronic interaction current $g_1/f_1 = (0.73^{+0.19}_{-0.68})$ was found, and with 95% confidence limits $0.58 \leq g_1/f_1 \leq 0.95$ was found. From this branching ratio, axial vector to vector form factor ratio, the Λ lifetime and the CVC value of weak magnetism, f_2/f_1, the Cabibbo angle was calculated to be equal to (0.242 ± 0.020). The analysis was corrected to eliminate the effects of the imposition of acceptance criteria, as well as the biases introduced during the detection and processing. The form factor ratio g_1/f_1 is insensitive to weak magnetism, f_2. The inclusion of second-class currents, via axial weak magnetism, g_2, results in a family of solutions for g_1/f_1: no unique solution can be found. (Diss. Abstr. Int., B)

15050 FORM FACTORS IN THE DECAY $\Sigma^- \to ne^-\bar{\nu}$. Tanenbaum, W. M. New Haven; Yale Univ. (1974). 201p. University Microfilms Order No. 74-26,345.

Thesis (Ph. D.).

The decay $\Sigma^- \to ne^-\bar{\nu}$ was studied in a 23 GeV/c negative hyperon beam at the Brookhaven AGS. The momentum of the Σ^- and of its charged decay products was measured by magnetic spectrometers with magnetostrictive wire chambers. The electron was identified by a threshold Cherenkov counter. A total absorption calorimeter identified a fast forward hadron whose interaction point was determined by a multiple layer sandwich of iron converters, wire proportional chambers, and scintillators. One thus has a zero constraint reconstruction with a twofold ambiguity. With a Σ^- flux of about 200 Σ^- per AGS pulse, one obtained about 3500 reconstructed events. A value of $|g_A/g_V|$ is derived from the neutron spectrum in the center of mass and a value of g_A/g_V from the electron spectrum. The values obtained are $|g_A/g_V| = 0.435 \pm 0.035$ and $g_A/g_V = 0.04 \pm 0.20$. (Diss. Abstr. Int., B)

15051 THE MUON (g-2) PRECESSION EXPERIMENTS: PAST, PRESENT AND FUTURE. Combley, F.; Picasso, E. (European Organization for Nuclear Research, Geneva (Switzerland)). Phys. Rep.; 14: No. 1, 1-58(Nov 1974).

In this review the various experiments completed or in preparation, which are designed to probe the anomalous magnetic moment of the muon to greater and greater precision, are surveyed. The emphasis lies particularly on the general issues involved and also on the most recent developments. (auth)

15052 RELATIVISTIC EFFECT ON MAGNETIC MOMENTS OF NEGATIVE MUONS BOUND TO HIGH-Z NUCLEI. Yamazaki, T.; Nagamiya, S.; Hashimoto, O.; Nagamine, K.; Nakai, K. (Tokyo Univ. (Japan). Dept. of Physics); Sugimoto, K. (Osaka Univ., Toyonaka (Japan). Dept. of Physics); Crowe, K. M. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Phys. Lett., B; 53: No. 1, 117-120(11 Nov 1974).

The g factors of the negative muons bound to Zn, Cd, and Pb nuclei have been determined. The observed values after the corrections for the internal fields have shown substantial deviations from the free-muon g factor: $(g_{free} - g)/g_{free}$ is $(1.3 \pm 0.6)\%$ for Zn, $(2.2 \pm 1.4)\%$ for Cd, and $(5.0 \pm 2.2)\%$ for Pb. These shifts are in good agreement with the relativistic binding corrections for finite-size nuclei calculated by Ford et al. (auth)

15053 DEEP INELASTIC LEPTON SCATTERING EXPERIMENTS AT NAL. Chen, K. W. (Michigan State Univ., East Lansing). pp 449-489 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

The topics discussed include the kinematics, salient features of deep inelastic electron scattering results from SLAC, open questions posed, and deep inelastic muon and neutrino scattering. (JFP)

Strong (Baryon-induced)

Refer also to abstract 15484.

15054 (CNRS-CPT-74-P-597) SPIN EFFECTS IN PROTON-PROTON ELASTIC SCATTERING NEAR THE FORWARD DIRECTION. Bourrely, C.; Soffer, J.; Wray, D. (Centre National de la Recherche Scientifique, 13-Marseille (France). Centre de Physique Theorique). Apr 1974. 17p. Dep. NTIS (US Sales Only) $4.00.

Several sets of experimental data on p-p elastic scattering in the Coulomb interference region in the range p(lab) between 9 and 500 GeV/c were analyzed, in order to estimate the size of the spin dependent part of the strong amplitude. If β is the ratio of this spin-dependent part to the spin independent amplitude in the forward direction, all the data strongly suggest but do not conclusively prove a nonnegligible β whose value is around 10% and approximately constant with energy. This result cannot be explained theoretically in terms of exchange of any simple factorizing Regge pole. Important pomeron cut contributions are suggested. Implication of the analysis for some experiments at ISR energies which appear to give rising total cross section are discussed. (auth)

15055 (COO-2232A-14) HIGHLIGHTS OF RECENT STRONG INTERACTION EXPERIMENTS AT FERMILAB. Cool, R. L. (Rochester Univ., N. Y. (USA)). 1974. Contract AT(30-1)-2232A. 42p. (CONF-740933-1). Dep. NTIS $5.25.

From meeting of the Division of Particles and Fields of the American Physical Society; Williamsburg, Virginia, USA (5 Sep 1974).

A review of selected results from recent experiments on strong interactions at the FERMILAB is given. (auth)

15056 (FERMILAB-Conf-74/68) RECENT FERMILAB BUBBLE CHAMBER EXPERIMENTS AND RESULTS. Voyvodic, L. (Fermi National Accelerator Lab., Batavia, Ill. (USA)). Jul 1974. 8p. (CONF-740629-4). Dep. NTIS $4.00.

From 5th international symposium on many particle hydrodynamics; Leipzig, F. R. Germany (4 Jun 1974).

An over-view is given of experiments using the 30-inch hydrogen bubble chamber during the past two years. Emphasis is given to increased capabilities provided by beam tagging and hybrid spectrometer systems in the more recent experiments. Summary results are discussed for pp and πp collisions at high energies in multiplicity distributions in exclusive and inclusive reaction studies. (auth)

15057 (IFVE-M-3) STUDY ON PHOTON PRODUCTION IN pp-INTERACTIONS AT 69 GeV/c. Ammosov, V. V.; Ermolov, P. F.; Kubik, V. M.; Moiseev, A. M.; Slobodyuk, E. A.; Starchenko, E. A.; Blyumenfel'd, G.; Grane, P.; Lozh'e, Zh.; Lore, M.; Provo, Zh.; Sodre, Zh.; Boatav, M.; Nguen, G. K. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 12p. (In Russian). INIS.

The results of processing on Mirabel bubble chamber photographs 728 conversion pairs formed in pp interactions at 69 GeV were reported. It was found that the average multiplicity $\langle n_{\pi^0} \rangle = 2.57 \pm 0.13$. The growth of the number of π^0 mesons as a function of the number of charged particles was observed up to n = 12. Data on the invariant cross section $F(x, p_t, s)$ for $pp \to \gamma X$ reactions were compared with results obtained at other energies. (tr-auth)

15058 (IFVE-M-4) INCLUSIVE K^0 AND Λ PRODUCTION IN pp-INTERACTIONS AT 69 GeV/c. Ammosov, V. V.; Ermolov, P. F.; Kubik, V. M.; Moiseev, A. M.; Slobodyuk, E. A.; Starchenko, E. A.; Blyumenfel'd, G.; Grane, P.; Lozh'e, Zh.; Lore, M.; Provo, Zh.; Sodre, Zh.; Boratav, M.; Tushar, A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 11p. (In Russian). INIS.

On the basis of the analysis of 180 V^0 events recorded in the Mirabel, the cross sections of the inclusive reactions $pp \to K^0X$ and $pp \to \Lambda X$ were determined as 8.4 ± 1.1 mb and 3.6 ± 0.5 mb, respectively. The data obtained on the invariant cross section $F(x, p_t^2, s)$ were compared with results at other energies. (tr-auth)

15059 (IPNO/TH-73-43) HIGH ENERGY PROTON-PROTON TOTAL CROSS SECTION AND COSMIC-RAY DATA. II. Auger, J. P.; Lombard, R. J. (Paris-11 Univ., 91-Orsay (France). Inst. de Physique Nucleaire). Dec 1973. 14p. Dep. NTIS (US Sales Only) $4.00.

The cross section of absorption of protons by air nuclei is discussed on the basis of new cosmic-ray data. The results are compared to theoretical estimates performed by using the multiple scattering theory and by assuming two different types of asymptotic behavior for the N-N scattering amplitude parameters. (auth)

15060 (NR-1421/VI/PH, pp 137-139) SINGLE-PARTICLE INCLUSIVE REACTIONS. Rybicki, K. 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

Previous work on the energy dependence of the average multiplicity is shown for incident momenta between 4 and 70 GeV/c and the dependence of the average-to-dispersion ratio versus the average multiplicity for single particle π-p and p-p inclusive interactions is briefly described. (JFP)

15061 (NR-1421/VI/PH, pp 140-142) SINGLE-PARTICLE INCLUSIVE REACTIONS. Wroblewski, A. 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

The connection between the average charge multiplicity and the dispersion of the multiplicity distribution is illustrated. All available experimental data for proton-proton interactions are shown. Also the predictions of different models for charged multiplicity distributions are plotted. (JFP)

15062 (NR-1421/VI/PH, pp 152-157) LONGITUDINAL DISTRIBUTIONS OF THE NET CHARGE IN π^+p INTERACTIONS AT 8 GeV/c. Blobel, V. (Bonn-Hamburg-Munich Collaboration). 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

Data from a pp experiment at 12 and 24 GeV/c in a hydrogen bubble chamber are studied for inclusive π^- and π^+ production. The cross sections are shown as a function of rapidity. (JFP)

15063 (NR-1421/VI/PH, pp 273-284) SUMMARY OF SOME RECENT RESULTS OBTAINED BY THE BRITISH-SCANDINAVIAN ISR-COLLABORATION. Boeggild, H. (CERN, Geneva). 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

A brief description of the experiment and a summary of the main results on $\bar{p}p$ annihilation at the ISR is given. Also an attempt to find the mean multiplicity of charged particles at the ISR energies is briefly described. The cross sections and various particle spectra are discussed. (JFP)

15064 (NR-1421/VI/PH, pp 314-347) MANY PARTICLE INCLUSIVE CROSS SECTIONS AND CORRELATIONS IN HADRONIC PRODUCTION PROCESSES AT VERY HIGH ENERGY. Koba, Z. (Niels Bohr Inst., Copenhagen). 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

The discussion covers the model independent aspects of many-particle inclusive cross sections and correlations in hadronic production processes at very high energy. Cross sections and correlations, kinematical constraints (sum rules), coexistence of two mechanisms are discussed. Also predictions of models

are treated covering the asymptotic behavior of correlations and comparison with experiments. (JFP)

15065 (NR-1421/VI/PH, pp 348-393) REVIEW OF EXPERIMENTAL RESULTS ON CORRELATIONS IN HIGH ENERGY INTERACTIONS. Morrison, D. R. O. (CERN, Geneva). 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

The review of experimental results on correlations in high energy interactions covers the GGLP effect, the transverse angle, clusters, two-dimensional plots, correlation functions, and correlation and multiplicity. (JFP)

15066 CHARGE PRONG MULTIPLICITY DISTRIBUTIONS IN PROTON–PROTON COLLISIONS AT 28.5 GeV/c. Clifford, T. S. Blacksburg, VA; Virginia Polytechnic Inst. and State Univ. (1974). 60p. University Microfilms Order No. 74-29,127.

Thesis (Ph. D.).

Using the Multiparticle Argo Spectrometer System, the charge prong multiplicity distribution was measured as a function of the kinematic variable of the fast recoil proton for 190,000 events in the reaction pp → p + ANYTHING at 28.5 GeV/c. The distributions are found to be similar to charge prong multiplicities for pp → ANYTHING at different energies. A KNO type scaling in W, $P_\perp$ and t was searched for, strong evidence was found only for scaling over W for a fixed range of t. Finally, the scaled distributions, both total and associated, as a function of W are presented for comparison. (Diss. Abstr. Int., B)

15067 PRODUCTION PROPERTIES OF LOW-MASS SYSTEMS IN pp COLLISIONS AT 102 GeV/c. De Brion, J. P.; Bromberg, C.; Ferbel, T.; Slattery, P. (Rochester Univ., N. Y. (USA)); Cooper, J.; Seidl, A.; Vander Velde, J. C. (Michigan Univ., Ann Arbor (USA)). Phys. Lett., B; 52: No. 4, 477-480(28 Oct 1974).

The properties of low-mass systems produced in the inclusive reaction p + p → p + anything are examined in detail. It is found that the internal characteristics of these low-mass nucleon–multipion systems (the "anything"), at fixed values of mass (M), are similar to those found for produced hadrons in high-energy collisions at fixed incident hadron energies ($\sqrt{s}$). The resemblance between the properties of the M^2 system and the characteristics of γp collisions at $s = M^2$ is particularly striking. (auth)

15068 HIGH ENERGY PHYSICS TODAY. Pandit, L. K. (Tata Inst. of Fundamental Research, Bombay (India)). Phys. News (India); 4: No. 1, 4-9(Mar 1973).

An overall review of the research in the field of high energy physics has been presented. It is based on the first output data provided by the latest high energy machine at NAL (Batavia) which has gone into operation recently. Observations are based on experiments conducted with protons of energy up to 300 GeV. (auth)

15069 THE INCLUSIVE REACTION pn → p+ ANYTHING IN THE n FRAGMENTATION REGION AT 11.6 GeV/c. Engler, A.; Hochman, D.; Eisenberg, Y.; Karshon, U.; Shapira, A.; Ronat, E. E.; Yekutieli, G. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Nuclear Physics). Nucl. Phys., B; 81: No. 3, 397-402(11 Nov 1974).

The inclusive reaction pn → p + anything has been studied in the fragmentation region of the neutron using pd interactions at 11.6 GeV/c beam momentum. It is found that for low values of transverse momentum p_t and $|x| \geq 0.7$ the one-pion-exchange contribution is significant. This is in qualitative agreement with the model of Bishari. (auth)

15070 ELECTROEXCITATION OF NUCLEON RESONANCES ON PROTONS AND NEUTRONS. Koebberling, M.; Moritz, J.; Schmidt, K. H.; Wegener, D.; Zeller, D. (Karlsruhe Univ. (TH) (F.R. Germany). Inst. fuer Experimentelle Kernphysik); Bleckwenn, J. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)); Heimlich, F. H. (Freiburg Univ. (F. R. Germany). Fakultaet fuer Physik). Nucl. Phys., B; 82: No. 2, 201-212(25 Nov 1974).

New data for the total absorption cross section of virtual photons on protons and deuterons are used to determine the excitation cross section of the three dominant nucleon resonances at W = 1236 MeV, W = 1520 MeV and W = 1685 MeV. The q^2 dependence of the excitation on protons and of the ratio for the excitation on deuterons and protons is given. The results are compared with the predictions of the symmetric quark model. (auth)

15071 PHYSICS AT THE ISR. A Review of Recent Issues. Jacob, M. (CERN, Geneva). Fields Quanta; 3: No. 4, 345-411 (Apr 1974).

A review of material during recent months since the Batavia conference is given including the questions of large transverse momentum secondaries, total cross sections, two-body correlations, and diffraction phenomena, with a brief mention of scaling. (JFP)

15072 $\bar{p}Dp\pi^+\pi^-$ FINAL STATE COHERENTLY PRODUCED BY 14.6 GeV/c ANTIPROTONS. Brick, D. (Centre de Recherches Nucleaires, Strasbourg); Fridman, A.; Gerber, J. P.; Michalon-Mentzer, M. E.; Schiby, B.; Brucker, E. B.; Grauman, J. U.; Koller, E. L.; Raths, O.; Stamer, P. E.; Taylor, S.; Handler, T.; Plano, R. J.; Preissner, H.; Watts, T. L. Nuovo Cim.; 24A: No. 2, 202-212(16 Nov 1974).

From 98,000 photographs taken at BNL with the 80 inch bubble chamber, the $\bar{p}d \rightarrow \bar{p}dp\pi^+\pi^-$ reaction at 14.6 GeV/c was studied for which a cross section of (0.30 ± 0.07) mb is obtained. Strong production of $\bar{\Delta}-(1236)$ and a low mass $d\pi^+$ enhancement at 2.2 GeV/c^2 are observed. A comparison of cross sections obtained from the available $\bar{p}d \rightarrow \bar{p}dp\pi^+\pi^-$ and $pd \rightarrow pdp\pi^+\pi^-$ reactions is made. Some of the production features are discussed. (auth)

15073 SEARCH FOR NUCLEON RESONANCES OF MASS UP TO 8.5 GeV. Abe, K.; Alspector, J.; Bomberowitz, R.; Cohen, K. J.; Colleraine, A. P.; Cvijanovich, G.; Delillo, T.; Harrison, W. C.; Mueller, J.; Oostens, J. (Rutgers–the State Univ., New Brunswick, N. J. (USA)). Phys. Lett., B; 53: No. 1, 114-116 (11 Nov 1974).

Missing mass spectra were obtained by measuring recoil protons from the reaction p + p → p + X in the Jacobian peak region. Data were taken during the acceleration ramp of the Fermilab machine using an internal hydrogen gas jet target. The well known N*(1688) and N*(2190) resonances were observed, but no significant structures at higher mass. (auth)

15074 OBSERVATION OF HIGH TRANSVERSE MOMENTUM ELECTRONS AT THE CERN ISR. Buesser, F. W.; Camilleri, L.; Di Lella, L.; Pope, B. G.; Smith, A. M. (European Organization for Nuclear Research, Geneva (Switzerland)); Blumenfeld, B. J.; White, S. N. (Columbia Univ., New York (USA)); Rothenberg, A. F.; Segler, S. L.; Tannenbaum, M. J. (Rockefeller Univ., New York (USA)). Phys. Lett.; B; 53: No. 2, 212-216(25 Nov 1974).

A search for high transverse momentum electrons directly produced in proton–proton collisions was performed at the CERN ISR. The apparatus included a magnetic spectrometer with wire spark chambers, a lead-glass counter array, and a threshold gas Cherenkov counter. At a center-of-mass energy $\sqrt{s} = 52.7$ GeV, a signal was observed in the range $1.6 < p_T^* < 4.7$ GeV/c. The signal occurs at a level of approximately 10^{-4} of the inclusive pion cross section. (auth)

15075 BUBBLE CHAMBER DATA FROM NAL. Ferbel, T. (Univ. of Rochester, NY). pp 3-37 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

A review is given of results from bubble chamber data on pp interactions. Multiplicities and partial cross sections, diffractive processes, and pion production and limiting behavior are considered. (JFP)

15076 RECENT RESULTS FROM EUROPEAN HIGH ENERGY ACCELERATORS. Morrison, D. R. O. (CERN, Geneva). pp 67-134 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

Experimental results on strong interactions at high energies are reviewed covering resonances–diffractive dissociation (<50 GeV/c), the quark search, neutrino physics–neutral currents, total cross sections, elastic scattering, scaling, multiplicity, diffraction dissociation (ISR results), large transverse momenta, and the picture of high energy reactions. (JFP)

15077 SURVEY OF BUBBLE CHAMBER PHYSICS IN JAPAN. Takahashi, K. (National Lab. for High Energy Physics, Oho, Japan). pp 135-153 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

The review covers present physics results by the Japanese groups and a brief sketch of the hydrogen bubble chamber now under construction. Multiparticle production and inclusive experiments and pp interactions at low energy are reviewed. (JFP)

15078 PRESENT STATUS OF NAL ACCELERATOR AND THE INTERNAL TARGET EXPERIMENTS. Yamada, R. (National Accelerator Lab., Batavia, IL). pp 171-183 of Proceedings of the

International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

Research on pp interactions is summarized, and the accelerator operation is described. (JFP)

Strong (Meson-induced)

Refer also to abstract 15176.

15079 (BNL-19451) LOW ENERGY s-CHANNEL PROCESSES WITH POLARIZED TARGETS. Sakitt, M. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 25p. (CONF-740673-5). Dep. NTIS $4.25.

From workshop on polarized targets; Upton, L. I., New York, USA (Jun 1974).

The experimental situation in low energy s-channel processes is reviewed with a view toward applications of polarized targets. The situation in both the I = 1 and 0 KN system is mainly described, and a few remarks are made about the $\overline{K}N$ system. Highlights are given rather than a detailed review. The typical results from current experiments and phase shifts analyses and the improvement resulting from some polarized target experiments are shown. (JFP)

15080 (IFA-HE-82-1973) NEUTRAL STRANGE PARTICLE PRODUCTION IN π^-p, $\pi^-\gamma$, AND π^-c INTERACTIONS AT 40 GEV/C. (Institutul de Fizica Atomica, Bucharest (Romania)). 1973. 26p. INIS.

Results are reported on the inclusive cross sections for $\Lambda(\Sigma^0)$ hyperons and K^0 mesons produced in π^-p, π^-n and π^-c interactions at 40 GeV/c in propane bubble chamber as well as the production cross sections for events of the type ΛK^0 and $K\overline{K}$. Results on the cross section measurements for the various topologies are presented too. It is found that $\sigma^{\pi^-}_{\Lambda(\Sigma^0)}$ has increased twofold from 25 to 40 GeV/c. The cross section for $K\overline{K}$ production is still growing with increasing incident energy. The average numbers for K^0 mesons and Λ hyperons per π^-p interaction are $\langle n_K \rangle = 0.24 \pm 0.03$ and $\langle n_\Lambda \rangle = 0.07 \pm 0.01$ respectively. The invariant single-particle distributions in Feynman variable x for the inclusive K^0_1 and Λ reactions are presented and compared with these for π^-p interactions at lower energies and pp interactions at 205 GeV as well. (auth)

15081 (IFVE-SEF-73-76) STUDY ON THE ENERGY DEPENDENCE OF CROSS SECTIONS FOR π^--MESON ELASTIC SCATTERING ON PROTONS IN THE RANGE OF 33 TO 35 GeV/c. Derevshchikov, A. A.; Matulenko, Yu. A.; Meshchanin, A. P.; Mysnik, A. I.; Nurushev, S. B.; Prosyurin, G. P.; Stkain, V. V.; Smirnov, E. V.; Solov'ev, L. F.; Solov'yanov, V. L. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 32p. (In Russian). INIS.

The differential cross sections of the elastic scattering of pions on protons were measured for eight momentum values in the interval from 33 to 55 GeV/c. The energy dependence of the slope and of total elastic scattering cross sections was determined from experimental data. The results were compared with published data. The experimental data were also compared with the predictions of the Regge model and of the quasipotential approximation model. (tr-auth)

15082 (INIS-mf-1426) STRANGE PARTICLE PRODUCTION IN 5 GeV/c π^+p COLLISIONS. Toet, D. Z. (Katholieke Universiteit Nijmegen (Netherlands)). 22 Mar 1974. 209p. INIS.

Thesis.

The reactions between π^+ mesons with a laboratory momentum of 5 GeV/c and protons were studied experimentally by means of the bubble chamber technique. The reactions analyzed are all characterized by the fact that so-called "strange particles", i.e. particles with a strangeness quantum number different from zero, occur among their end products. A description is given of: the experimental conditions during the exposure, the scanning, the geometrical and kinematical reconstruction techniques and the methods used for the resolution of kinematical ambiguities. The methods used in the determination of the cross sections of the strange-particle channels and the results obtained are presented. The resonance production in the statistically more significant three- and four-body channels is dealt with. An introduction to the methods used for quantitative determination of resonance production is followed by a channel-by-channel discussion of the results. The four reactions $\pi^+p \to K^+\Sigma^+$, $\pi^+p \to K^{*+}(890)\Sigma^+$, $\pi^+p \to K^+\Sigma$ (1385) and $\pi^+p \to K^{*+}(890)\Sigma^+(1385)$ are examined. The total and differential cross sections and the spin-density matrix elements are determined and compared with predictions of some exchange models as well as with results from other experiments. In general the agreement is reasonable to good. In $K^{*+}(890)\Sigma^+$, the dip in the forward differential cross section, predicted by the model of Chilton et al., is confirmed by the observations, in contrast with the experimental results obtained at 5.4 GeV/c. SU(3) predictions, relating the cross sections of these reactions to those of other π^+p and KN reactions are in general reasonably well satisfied. (auth)

15083 (ITEF-71) π^-d$^-$ ELASTIC BACKSCATTERING AT 1.68, 2.11, 2.64, AND 3.28 GeV/c. Abramov, B. M.; Vladimirskii, V. V.; Dzhelyadin, R. I.; Dkhovskoi, I. A.; Kishkurno, V. V.; Kurtenkova, A. P.; Kulikov, V. V.; Radkevich, I. A.; Fedorets, V. S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1973. 12p. (In Russian). INIS.

The differential cross section for the elastic π^-d backscattering was measured as $d\sigma/d\Omega\ (180°) = 0.26^{+0.13}_{-0.13}$ μb/sr for π^- mesons at 1.68 GeV/c. For momenta of 2.11, 2.64, and 3.28 GeV/c upper limits were obtained for the cross sections; they were 0.31, 0.21, and 0.83 μb/sr, respectively, (at a 90% confidence level). (tr-auth)

15084 (LPTHEX-T-74-01) STUDY OF THE $\pi^+p \to \pi^+p + n\pi^0$ (n = 1,2,3) REACTIONS AT 3.5 GeV/c. Mine, P. (Ecole Polytechnique, 75—Paris (France). Lab. de Physique des Hautes Energies). Mar 1974. 240p. (In French). Dep. NTIS (US Sales Only) $15.00.

Thesis. Submitted to Paris Univ. (France).

The subject is the study of the reactions $\pi^+p \to \pi^+p\pi^0\pi^0$ and $\pi^+p \to \pi^+p\pi^0\pi^0\pi^0$ produced at 3.5 Gev/c in the CERN 1m^3 heavy liquid bubble chamber. Only the events with all γ's materialized were taken. Although the kinematical fits were highly constrained, some ambiguities remained. They were resolved using the chi^2 fit probability and detailed scanning information. The background due to nuclear events was found to be 15 ± 2%. The cross sections, mass spectra and Van Hove plot were given for the two reactions. The reactions: $\pi^+p \to \pi^+p\pi^0$ was also studied, and the results compared to existing data. Finally a model for the $3\pi^0$ system using $\pi\pi$ phase shifts was proposed. The experimental results were discussed in the framework of the model. (auth)

15085 (NR-1421/VI/PH, pp 143-146) SINGLE-PARTICLE INCLUSIVE REACTIONS. Piotrowska, H. 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

Some results on π^-p and π^-n interactions at 40 GeV/c in a propane bubble chamber are presented. The e^+e^- pairs from γ conversion give information on π^0 production. The average number of π^0 and its dependence on charged multiplicity are discussed. It is noted that the observed dependence of π^0 number on charged number can be reconciled with the isospin independence hypothesis. (JFP)

15086 (NR-1421/VI/PH, pp 394-403) CORRELATIONS BETWEEN PION PAIRS FROM K^+p INTERACTIONS. Lander, R. L. 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

Two correlation functions are used to show some of the many possible correlations that exist between pairs of pions from data from the reaction $K^+ + p \to 2\pi$ + anything at 11.8 GeV/c. (JFP)

15087 (NR-1421/VI/PH, pp 646-657) RECENT DEVELOPMENTS IN FRAGMENTATION MODELS. Wang, J. M. 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

The high energy predictions of the fragmentation models for the two-particle correlation functions are presented. An ISR experiment is proposed which may kill one of the two classes of models. Previous data for $\pi^+(\pi^-)p \to 2\pi^-X$ reactions at 8 and 18 GeV/c are presented. (JFP)

15088 (RL-74-127) π—DEUTERON SCATTERING. Bugg, D. V. (Science Research Council, Chilton (UK). Rutherford Lab.). Sep 1974. 18p. (CONF-740822-8). Dep. NTIS (US Sales Only) $4.00.

From conference on few-body problems in nuclear and particle physics; Quebec, Canada (27 Aug 1974).

What happens in πd scattering which cannot be understood directly from present knowledge of πN? Experimental data on total cross sections and elastic scattering are reviewed from threshold to the GeV region, with particular attention to recent results. A new measurement of the scattering length, from the strong interaction shift in the ground state of the mesic atom, agrees with πN scattering lengths and multiple scattering theory. Elastic scattering at high energy and small angles now agrees well with Glauber theory. However, the magnitude of the contribution of inelastic states to Glauber shadowing in the total cross section is

confused both experimentally and theoretically. At large angles and low energy, the Glauber approximation fails. Recent calculations of Gabathuler and Wilkin (Nucl. Phys.; B70: 215(1974)) using multiple scattering theory improve agreement with data in the N*(1230) region. Total cross sections in the resonance region may now be explained quantitatively by collision broadening of the resonance on the spectator nucleon; a modification of Glauber theory to accommodate this is given. The choice of kinetics for πN collisions in the deuteron is settled by appeal to experiment. The way of handling the channel $\pi d \rightarrow NN$ is clarified. Other examples of collision broadening are discussed in π-nucleus total cross sections and in high energy hadron collisions. (auth)

15089 MEASUREMENT OF THE CROSS SECTION FOR $\pi^+p \rightarrow \pi^+\pi^+n$ NEAR THRESHOLD. Crouch, J. H. College Park, MD; Univ. of Maryland (1974). 148p. University Microfilms Order No. 74-29,063.

Thesis (Ph. D.).

An experiment to measure the cross section for the reaction $\pi^+p \rightarrow \pi^+\pi^+n$ at an incident pion kinetic energy of 195 MeV or 23 MeV above the threshold. The cross section is expected to be a few microbarn at 195 MeV. The experiment was performed in a high intensity π^+ beam built at the N.A.S.A. Space Radiation Effects Laboratory. The apparatus included a large digitized neutron detector array, four streamer chambers, numerous scintillation counters, and a hydrogen gas target. Data were collected for each event-trigger simultaneously on film and magnetic tape and were later analyzed to identify $\pi^+p \rightarrow \pi^+\pi^+n$ events. The analysis produced a sample of 13 ± 9 events and an unidentified background of ~30 events. This resulted in a cross section of $(6.3 \pm 4.3)\mu b$ which is consistent with the prediction of the $\pi\pi$ theory of Schwinger, but does not exclude that of Weinberg. (Diss. Abstr. Int., B)

15090 REACTION $\pi^+p \rightarrow \pi^+p\pi^+\pi^-\pi^0$ AT 13.1 GeV/c. Mulera, T. A. Lafayette, IN; Purdue Univ. (1974). 159p. University Microfilms Order No. 74-26,755.

Thesis (Ph. D.).

Results are presented from a study of the four prong single constraint reaction $\pi^+p \rightarrow \pi^+p\pi^+\pi^-\pi^0$ obtained from a 750,000 picture exposure of the SLAC 82" hydrogen bubble chamber to positive pions at an incident momentum of 13.1 GeV/c. The acquisition and reduction of the experimental data are described. The reaction cross section for this channel is determined to be 1.052 ± 0.057 mb. Cross sections for the four constraint and zero-constraint channels and for various subsets of the single-constraint channel are presented. The $(4\pi)^+$ system produced opposite the proton is studied with emphasis on meson production in the R region. Comparisons are made with the results of the CERN and Northeastern-SUNY spectrometer experiments and branching ratios for various decay modes are calculated. The quasi two-body reaction $\pi^+p \rightarrow \omega^0\Delta^{++}$ is studied. Both the joint statistical tensors and the single-vertex density matrix elements are derived from the angular distributions. These results are interpreted in terms of the exchange mechanisms dominant in various regions of momentum transfer. (Diss. Abstr. Int., B)

15091 A STUDY OF $\pi^-p \rightarrow f^0n$ REACTION AT MOMENTA UP TO 50 GeV/c. Bolotov, V. N.; Isakov, V. V.; Kakauridze, D. B.; Khaustov, G. V.; Prokoshkin, Yu. D.; Sadovsky, S. A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). Phys. Lett., B; 52: No. 4, 489-492(28 Oct 1974).

A mass spectrum of the $\pi^0\pi^0$ system in the final state of the $\pi^-p \rightarrow \pi^0\pi^0n$ reaction has been studied at momenta of 20 to 50 GeV/c. The experiments were performed at the 70 GeV IHEP accelerator. In the mass distribution there has been selected a peak corresponding to the f^0 meson. The f^0 meson production cross section decreases as a power function of the momentum. The differential cross section has an exponential dependence, exp (bt). The mass spectrum of the unbound $\pi^0\pi^0$ system is satisfactorily described with a multireggeon diagram of ρ and π exchange. (auth)

15092 ANALYSIS OF $\pi N \rightarrow K\Lambda$ AND $\bar{K}N \rightarrow \pi\Lambda$ USING FIXED-t DISPERSION RELATIONS, FESR AND DUALITY. Devenish, R. C. E. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)); Froggatt, C. D. (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)); Martin, B. R. (University Coll., London (UK)). Nucl. Phys., B; 81: No. 2, 330-348(4 Nov 1974).

A simultaneous analysis of low energy ($W \leq 2$ GeV) data for the reactions $\pi^-p \rightarrow K^0\Lambda$ and $K^-p \rightarrow \pi^0\Lambda$ was made using the hypothesis of two-component duality combined with fixed-t dispersion relations. Results are presented for the $\Sigma^*\Lambda\pi$ and $N^*\Lambda K$ couplings. The low energy amplitudes are used to evaluate FESR integrals and lead to large EXD breaking for the $K_V^+ - K_T^+$ helicity flip amplitudes. (auth)

15093 K^+p INTERACTIONS NEAR 3 GeV/c. I. Elastic Scattering. Yuta, H.; Bock, G.; Musgrave, B.; Peeters, P.; Schreiner, P.; Whitmore, J. (Argonne National Lab., Ill. (USA)). Nucl. Phys., B; 81: No. 2, 189-204(4 Nov 1974).

K^+p elastic scattering is studied at incident K^+ beam momenta of 2.53, 2.76 and 3.20 GeV/c. From the analysis of about 10000 elastic events at each energy, data on the forward and backward elastic scattering peaks are presented. No structure is observed in the forward peak for $-t < 2(\text{GeV/c})^2$. In addition, the statistics available from this exposure permit a measurement of the differential cross sections near 90° in the center of mass system. These results exhibit a strong energy dependence and are compared to similar results at other energies. (auth)

15094 RESONANCE PRODUCTION IN THE REACTION $\gamma p \rightarrow p\pi^+\pi^-\pi^+\pi^-$ IN THE ENERGY RANGE $E_\gamma = 3.0 - 18.0$ GeV. Schacht, P.; Derado, I.; Fries, D. C.; Park, J.; Yount, D. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (F. R. Germany)). Nucl. Phys., B; 81: No. 2, 205-230(4 Nov 1974).

The reaction $\gamma p \rightarrow p\pi^+\pi^-\pi^+\pi^-$ is studied from the point of view of resonance production. Data from the DESY and SLAC streamer-chamber experiments are combined to permit a consistent analysis over the energy range of $E_\gamma = 3$ to 18 GeV. Cross sections, invariant-mass, momentum-transfer, and other experimental distributions are given. A maximum-likelihood fit is performed to give quantitative results on the production cross sections of the identifiable resonance channels present. In addition to the usual invariant-mass and momentum transfer plots, diagrams suggested by the LPS and inclusive descriptions are used to test the quality of the fits and to emphasize aspects of this reaction. A combination of noninterfering peripheral resonance-production channels is found to describe adequately the reaction in all E_γ intervals studied. In particular, it is found that ρ' (~1500 MeV) production is required by the data. Other resonance-production channels important over this energy range are $\gamma p \rightarrow p\rho^0\pi^+\pi^-$ and $\gamma p \rightarrow \Delta^{++}\pi^-\rho^0$. Evidence for $\gamma p \rightarrow \Delta^{++}A_1^-$ and $\gamma p \rightarrow \Delta^{++}A_2^-$ is found only for $E_\gamma < 6.5$ GeV. Part of the Δ^{++} production may be explained by the cascade decay $N^* \rightarrow \Delta^{++}\pi^-$. (auth)

15095 STUDY OF THE REACTIONS $\pi^+p \rightarrow \Delta^{++}\pi^0$ AND $\pi^+p \rightarrow \Delta^{++}\eta$ AT 5.45 GeV/c. Bloodworth, I. J.; Jackson, W. C.; Merdjanian, H.; Prentice, J. D.; Yoon, T. S. (Toronto Univ., Ontario (Canada). Dept. of Physics). Nucl. Phys., B; 81: No. 2, 231-248 (4 Nov 1974).

Results are presented on the quasi-two body reactions $\pi^+p \rightarrow \Delta^{++}\pi^0$ and $\pi^+p \rightarrow \Delta^{++}\eta$ at 5.45 GeV/c. Differential cross sections and Δ^{++} spin density matrix elements in the t- channel and s-channel helicity systems are presented and compared with a Regge exchange model and the dual absorptive model. (auth)

15096 HIGH-ENERGY PRODUCTION AND DECAY OF VECTOR AND TENSOR MESONS. Irving, A. C.; Michael, C. (European Organization for Nuclear Research, Geneva (Switzerland)). Nucl. Phys., B; 82: No. 2, 282-312(25 Nov 1974).

The available charge-exchange data for $\pi N \rightarrow \rho N$, $\pi N \rightarrow \omega N$, and $\rho - \omega$ interference effects in the momentum range 6 to 17 GeV/c are analyzed. Duality considerations are used to constrain as much as possible the exchanged Regge poles and also to relate their contributions to those made by the same Regge exchanges in $\pi N \rightarrow f^0N$ and $\pi N \rightarrow A_2N$. Combined with an empirical investigation of the Regge cut contributions this allows a simultaneous description of vector and tensor meson production. The resulting amplitudes are used to predict interference effects in the common $K\bar{K}$ decay channel of f^0 and A_2. Other predictions include $K^*(1420)$ and $\bar{K}^*(1420)$ production, and many polarization effects. (auth)

15097 DETERMINING THE PARAMETERS OF NARROW RESONANCES. Donald, R. A.; Edwards, D. N.; Myers, D. R. (Liverpool Univ. (UK)); Campbell, C. J.; Clayton, E. F.; Negus, P. J. (Glasgow Univ. (UK). Dept. of Natural Philosophy). Nucl. Instrum. Methods; 121: No. 1, 181-183(1 Oct 1974).

A method is described of determining both the real width and the mass resolution of resonant structures in high energy physics. This method is not dependent on an a priori knowledge of measuring errors. The method is applied to the ω^0 meson as an example. (auth)

15098 A MULTIDIMENSIONAL STUDY OF CLUSTERING IN THE REACTION $\pi^+p \rightarrow p\pi^+\pi^+\pi^-$ AT 8 GeV/c. Boettcher, H.; Kostka, P.; Lanius, K.; Roloff, H.; Schiller, H. (Deutsche Akademie der Wissenschaften zu Berlin (German Democratic Republic)). Nucl. Phys., B; 81: No. 3, 365-377(11 Nov 1974).

A study of clustering of four-prong events is presented. The method used does not need any a priori knowledge about the reac-

tion mechanisms involved. The classification of each event is done using the kinematical information contained in the whole sample of events. The clusters found are closely related to the main reaction mechanisms. The method is also easily applicable to other reaction channels. (auth)

15099 FORMALISM AND ASSUMPTIONS INVOLVED IN PARTIAL-WAVE ANALYSIS OF THREE-MESON SYSTEMS. Hansen, J. D.; Jones, G. T.; Otter, G.; Rudolph, G. (European Organization for Nuclear Research, Geneva (Switzerland)). Nucl. Phys., B; 81: No. 3, 403-430(11 Nov 1974).

The Illinois group has made a partial-wave analysis of the reaction $\pi p \to (3\pi)p$. The Illinois program has been modified to study the reaction $Kp \to (K\pi\pi)p$. In this paper a detailed description is given of the partial-wave analysis of any reaction of the kind: meson + proton → proton + (3 mesons). It is also shown that, with little modification, the method can be applied to the study of special four-meson systems like $K\omega$. A discussion is given of the physical assumptions used and of their implications. (auth)

15100 THE π^+p INTERACTION AT 1.2 GeV/c. Berthon, A.; Mas, J.; Narjoux, J. L. (College de France, 75 - Paris); Guevara, P. L. de (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Nucl. Phys., B; 81: No. 3, 431-444(11 Nov 1974).

Experimental results are presented for the available channels in the 1.2 GeV/c π^+p interaction. An isobaric model with incoherent addition of the amplitudes is used to determine the ρ, Δ and N^* abundance rates in the $\pi^+\pi^0p$ final state. The multipole parameters in the density matrix of the Δ^{++} are determined as functions of its production angle. (auth)

15101 A TEST OF THE OPTICAL THEOREM. Eberhard, P. H.; Tripp, R. D. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.); Declais, Y.; Seguinot, J. (Caen Univ., 14 (France)); Baillon, P.; Bricman, C.; Ferro-Luzzi, M.; Perreau, J. M.; Ypsilantis, T. (European Organization for Nuclear Research, Geneva (Switzerland)). Phys. Lett., B; 53: No. 1, 121-124(11 Nov 1974).

Forward differential cross sections for π^-p elastic scattering at 1.0, 1.5 and 2.0 GeV/c show that the square of the imaginary parts of the nuclear scattering agrees with the optical theorem prediction within ±3%, when averaged over the three momenta. (auth)

15102 STUDY OF THE REACTION $\pi^-p \to \omega^0n$ AT MOMENTA 20 TO 50 GeV/c. Bolotov, V. N.; Isakov, V. V.; Kakauridze, D. B.; Khaustov, G. V.; Prokoshkin, Yu. D.; Sadovsky, S. A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). Phys. Lett., B; 53: No. 2, 217-220(25 Nov 1974).

The mass spectrum of 3γ states produced in π^-p collisions was studied. A peak corresponding to $\omega^0 \to \pi^0\gamma$ decay in the $\pi^-p \to \omega^0n$ reaction was selected. The measurements were performed at the IHEP accelerator at momenta 21, 25, 32.5, 40, and 48 GeV/c. The reaction cross section decreases with the momentum in a power form ($\sim p^{-3.4}$). The differential cross section follows exponential t-dependence, exp (bt). The scattering cone shrinks slowly with the energy increase. (auth)

15103 REVIEW OF COUNTER EXPERIMENTS AT INS. Kondo, K. (Tokyo Univ.). pp 38-64 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

Recent counter experiments on single pion photoproduction from nucleons made using the 1.3-GeV electron synchrotron are reviewed. Resonance excitations above the first resonance and photoproduction in the first resonance region and problems of exotic currents are discussed. (JFP)

15104 SPIN-PARITY ANALYSIS OF THE B MESON. Chung, S. U. (Brookhaven National Lab., Upton, NY); Protopopescu, S. D.; Alston-Garnjost, M.; Barbaro-Galtieri, A.; Flatte, S. M.; Friedman, J. H.; Lynch, G. R.; Ott, R. L.; Rabin, M. S.; Solmitz, F. T. pp 184-199 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

It is shown, based on a large sample of B mesons, what can be concluded about the spin-parity of the B meson, if interference effects are allowed in the analysis. In addition, an attempt is made to determine explicitly the production and decay parameters of both the resonating and nonresonating $\pi\omega$ system from threshold through the B region. The data come from π^+p interactions at 7.1 GeV/c. It is found that the B meson has a spin greater than zero and belongs to the unnatural spin-parity series. The results accommodate a simple quark picture of mesons. (JFP)

15105 CONTRIBUTION OF POLARIZATION EXPERIMENTS TO THE DETERMINATION OF THE ELASTIC PION-NUCLEON SCATTERING AMPLITUDES. Van Rossum, L. (CEN de Saclay, Gif-sur-Yvette, France). pp 338-358 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

The discussion of the contribution of polarization experiments to the determination of the elastic pion-nucleon scattering amplitudes covers the CERN and Serpukhov experiments on P and R and amplitude analysis of πN scattering at 6 and 16 GeV/c. (JFP)

15106 RESULTS ON NEUTRAL ASSOCIATED PRODUCTION AND PLAN FOR BNL MULTIPARTICLE SPECTROMETER PROJECT: OUR SPECTROMETER PROGRAM, PAST AND FUTURE. Ozaki, S. (Brookhaven National Lab., Upton, NY). pp 595-628 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

Some results from a series of experiments using the double vee magnetic spectrometer are presented, and the plan for the new multiparticle spectrometer facility is described. The reactions πp and Kp with strange-particle production are summarized. (JFP)

Particle Interactions and Properties (Theoretical)

General

Refer also to abstract 15043.

15107 (HU-TFT-74-12) QUARK MODEL WITHOUT SCALING PROPERTY. Raitio, R. (Helsinki Univ. (Finland). Research Inst. for Theoretical Physics). 1974. 20p. Dep. NTIS (US Sales Only) $4.00.

A simple field theoretic quark model is proposed in which the quarks are composite. This quark bootstrap is the new feature of the model. Applications to spectroscopy and deep inelastic processes are considered. A number of testable predictions are given. In particular, the ratio $R = \sigma(e^+e^- \to \text{hadrons})/\sigma(e^+e^- \to \mu^+\mu^-)$ is predicted to grow linearly with Q^2 at least until $\sqrt{Q^2} \sim 6$ GeV, where R is about 7, and drop thereafter towards a value of about one. (auth)

15108 (IC-73-7) ELEMENTARY PARTICLES IN A CURVED SPACE. Part II. Fronsdal, C. (International Centre for Theoretical Physics, Trieste (Italy)). Jan 1972. 28p. INIS.

This is an attempt to develop conventional, contemporary, elementary particle physics in a Riemannian space of constant curvature. The global structure of the 3 + 2 de Sitter space is studied which is taken to mean the covering space of the hyperboloid $y_5^2 - y^2 + y_4^2 = \rho^{-1}$ in a five-dimensional Minkowski space. This space is not periodic in time. A casual structure is shown to exist and the commutation relations between free fields are shown to be casual. Elementary massive particles are associated with a class of irreducible representations of the universal covering group of SO (3,2) for which the Hamiltonian has a discrete spectrum with a lower (positive) bound. A detailed study is made of the wave functions in "momentum space" and in configuration space. Free quantum fields are introduced with the help of a discrete set of creation and destruction operators and the commutator $[\phi_0(x), \phi_0(x')]$ is calculated. What is thought to be an interesting way to realize irreducible representations of the "discrete series" in a space that is essentially L^2 is described. (auth)

15109 (ITF-73-28E) POMERON IN DUAL AMPLITUDE WITH MANDELSTAM ANALYTICITY. Burgii, A. I.; Enkovskii, L. L.; Kobylinskii, N. A.; Shelest, V. P. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1973. 12p. INIS.

The problem of including the Pomeron in dual amplitude with Mandelstam analyticity (DAMA) is studied. The possibilities of a Pomeron being a simple or a multifold pole are studied in detail. The nature of singularities dual to the Pomeron is also discussed. (auth)

15110 (NR-1421/VI/PH) PROCEEDINGS OF THE III INTERNATIONAL COLLOQUIUM ON MANY-BODY REACTIONS, ZAKOPANE, POLAND, 20-24 JUNE 1972. (Institute of Nuclear Research, Warsaw (Poland)). 1972. 697p. (CONF-720640-).

The conference included 45 papers two of which were abstracted previously in NSA as: 28: 11646 and 29: 1063. Separate abstracts were prepared for the remaining 43 papers. (JFP)

For abstracts of individual papers see: 15042, 15060–15065, 15085–15087, 15111–15121, 15174–15178, 15220–15228, 15241–15247, and 15268.

15111 (NR-1421/VI/PH, pp 2-58) EXPERIMENTAL RESULTS ON EXCLUSIVE REACTIONS. Verbeure, F. 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

The review covers some general characteristics such as charge multiplicities and correlations and various methods of analysis and the results obtained with them. Also longitudinal phase space, prism plot, and spin–parity analyses, and isospin separation are included. (JFP)

15112 (NR-1421/VI/PH, pp 175-178) SEMI-INCLUSIVE EXPERIMENTS. Olesen, P. 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

A brief review of the present situation with respect to semi-inclusive experiments is given. The scaling predictions and the behavior at fixed multiplicity are discussed. (JFP)

15113 (NR-1421/VI/PH, pp 182-219) GENERALIZED OPTICAL THEOREM. Hoyer, P. 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

Some of the applications of the generalized optical theorem are discussed including the Regge model for the discontinuity, duality in the fragmentation limit, factorization of the Pomeron and meson trajectories, the central region, and finite-mass sum rules. (JFP)

15114 (NR-1421/VI/PH, pp 420-426) SPIN DEPENDENCE IN INCLUSIVE REACTIONS. Abarbanel, H. (National Accelerator Lab., Batavia, IL). 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

Two kinds of spin correlations in inclusive reactions are studied. One is a spinning particle and the other is a two nonspinning particle with an effective spin through their relative orbital angular momentum. (JFP)

15115 (NR-1421/VI/PH, pp 427-428) DEPENDENCE OF THE AVERAGE π^0 MULTIPLICITY ON THE NUMBER OF CHARGED PARTICLES AND ON THE ENERGY. Pokorski, S. 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

A scaling relation is proven and the shape of the function F (an arbitrary function in this relation) is discussed and related to inclusive correlations in the pionization region between neutral and charged pions. (JFP)

15116 (NR-1421/VI/PH, pp 430-435) GRAND CANONICAL AND SEMI-INCLUSIVE SINGLE PARTICLE DISTRIBUTIONS. Biebl, K. J. (Institut fuer Hochenergiephysik, Berlin). 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

For the consideration of the grand canonical and semi-inclusive single particle distributions the viewpoint is taken that the generating function considered by Mueller should be regarded as a grand canonical total cross section for the reaction $a + b \rightarrow X_{charged}(z) + X_{neutral}$. (JFP)

15117 (NR-1421/VI/PH, pp 436-440) TWO PARTICLE CORRELATIONS FROM THE MULTIPERIPHERAL-THERMODYNAMIC MODEL. Ranft, J.; Ranft, G. (Karl-Marx-Univ., Leipzig). 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

Starting from a model which described the single particle spectra rather well, it is determined which new information can be obtained from applying this model to inclusive two-particle distributions and correlations. The inclusive distribution of two newly produced particles is considered. At the energies considered both particles result from the decay of the same single fireball. (JFP)

15118 (NR-1421/VI/PH, pp 512-529) DIFFRACTION DISSOCIATION. Abarbanel, H. (National Accelerator Lab., Batavia, IL). 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

The nature of various reactions, elastic, and inelastic, which persist as the incident energy in a collision becomes very large is discussed. Included are transition matrix elements, the exchange mechanism in diffractive scattering, and the structure of the interacting Reggeon propagator. (JFP)

15119 (NR-1421/VI/PH, pp 552-581) PERSPECTIVES IN THE SYSTEMATIC STUDY OF MULTIPARTICLE REACTIONS. Van Hove, L. (CERN, Geneva). 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

The discussion of certain perspectives in the systematic study of multiparticle reactions covers the uncorrelated jet, thermodynamical, diffraction excitation, multiperipheral, nova, and fireball models. Single-particle distributions, correlations and quantum numbers exchanges, few-body collisions, diffraction dissociation, double diffraction dissociation, and from few- to many-body processes. (JFP)

15120 (NR-1421/VI/PH, pp 603-607) MODEL LEADING TO POSITIVE SECOND ORDER CORRELATIONS ($D^2-\langle n\rangle$) AND CONSTANT $D/\langle n\rangle$ IN HIGH ENERGY PRODUCTION PROCESSES. Giovannini, A. 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

The multi-Regge model is considered in its one-dimensional version previously obtained in the strong ordering limit by neglecting the Pomeron-Reggeon–particle vertex and the transverse degree of freedom. The total production cross sections are discussed. (JFP)

15121 (NR-1421/VI/PH, pp 658-667) PRESENT TRENDS OF MULTIPERIPHERALISM. Caneschi, L. (CERN, Geneva). 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

The discussion of present trends in multiperipheralism includes one-particle distributions. It is considered how the described qualitative features fit with the expectations based on multiperipheral picture. (JFP)

15122 (SLAC-176) DATA ANALYSIS TECHNIQUES FOR HIGH ENERGY PARTICLE PHYSICS. Friedman, J. H. (Stanford Linear Accelerator Center, Calif. (USA)). Sep 1974. Contract AT(04-3)-515. 100p. Dep. NTIS $8.00.

Useful techniques for the statistical analysis and presentation of high energy particle physics data are described and discussed. (auth)

15123 SOLVABLE ONE-DIMENSIONAL MODELS OF PARTICLE PRODUCTION. Peccei, R. D. Nucl. Phys., B; 81: No. 2, 301-316(4 Nov 1974).

A variety of simple one-dimensional models are discussed for particle production. For each of these models a closed form is derived for the generating functional which allows one to calculate the totality of inclusive, semi-inclusive and exclusive distributions. The models discussed include an n-trajectory multiperipheral model and a general cluster model. In this latter model a parameter independent relation is derived between semi-inclusive and inclusive cross sections. (auth)

15124 SIGNATURE AND UNITARITY IN THE MULTI-REGGE MODEL. Halliday, I. G. (Imperial Coll. of Science and Technology, London (UK). Dept. of Physics). Nucl. Phys., B; 81: No. 2, 253-262(4 Nov 1974).

It was previously shown how factorization and signature properties for production processes arose from a well defined set of singularities in complex angular momentum and helicity. These arose for Feynman diagrams without crossed channel singularities. It is shown how the general case gives rise to a sum of terms of this form. It is also shown how these precise singularities are crucial to prevent the occurrence of terms in inclusive pionization cross sections which are much greater than the canonical pomeron terms. (auth)

15125 EXCHANGED NATURALITY CONTRIBUTIONS FROM HIGH-ENERGY POLARIZATION MEASUREMENTS IN TWO-BODY INCLUSIVE AND EXCLUSIVE REACTIONS. Ader, J. P.; Salin, Ph. (European Organization for Nuclear Research, Geneva (Switzerland)); Meyers, C. (Bordeaux-1 Univ., 33 - Talence (France). Lab. de Physique Theorique). Nucl. Phys., B; 82: No. 2, 237-281(25 Nov 1974).

Dealing with high energy quasi-two-body or multiparticle production, what can be learned about exchanged naturality amplitudes from final polarization measurements with polarized or unpolarized beam and/or target is considered. The separation of t-channel (boson exchange) and u-channel (baryon exchange) exchanges into components of natural and unnatural parity and the measure of naturality interferences are extensively studied in all cases which are now or will be soon available with present

experimental techniques. Special attention is paid to the transversity amplitudes which are shown to be always naturality conserving. (auth)

15126 CORRECTIONS TO KNO SCALING. Auerbach, S. P. (California Univ., Berkeley (USA). Dept. of Physics). Nucl. Phys., B; 82: No. 2, 221-236(25 Nov 1974).

Recent data from NAL, together with a reanalysis of older data, indicate that there are substantial corrections to KNO scaling. With this in mind a simple argument, involving the generating function of the power moments $\langle n^q \rangle$, is used to deduce the form of corrections to KNO scaling at finite energies. Mueller's gas analog model with long range order is worked out explicitly; the corrections are -30% for $n = \langle n \rangle$ at 400 GeV, and -20% at 10 TeV, if experimental values of $\langle n \rangle$ and f_2 are used. A test of the experimental data for these correction terms is presented. Correction terms of the order of 30% are not ruled out, although no positive evidence for their existence is found. A discussion of the area under the KNO scaling curve is given. This, and related questions, turn out to be somewhat subtle. A surprising result is that the area under the KNO scaling curve is not guaranteed to equal unity. (auth)

15127 THE SHAPE OF THE QUASI-ELASTIC PEAK. Jacob, M.; Stroynowski, R. (European Organization for Nuclear Research, Geneva (Switzerland)). Nucl. Phys., B; 82: No. 2, 189-200 (25 Nov 1974).

The analysis of single diffractive excitation at very high energies suggests that the corresponding differential cross section could be very different from that found for elastic diffractive scattering. Differential cross section and polarization measurements for $|t| < 1$ (GeV/c)^2, could show prominent structures, the existence of which is motivated. This is particularly the case if one assumes that the reaction occurs predominantly without helicity flip as expected for a highly coherent process. (auth)

15128 ON THE CHARGE STRUCTURE OF HIGH-ENERGY MULTIPLE PRODUCTION. Grassberger, P.; Miettinen, H. I. (European Organization for Nuclear Research, Geneva (Switzerland)). Nucl. Phys., B; 82: No. 1, 26-44(18 Nov 1974).

Correlations between neutral and charged particles produced in high energy collisions are studied. The associated average multiplicity $\langle n_0 \rangle_{n_-}$ and the associated moment $\langle f_2^0 \rangle$ are expressed in terms of the Mueller moments. An isospin analysis of the pion-pion correlations is performed with the help of Mueller-Regge techniques. From this analysis, the slope of $\langle n_0 \rangle n_-$ is predicted to be asymptotically about 0.75. This asymptotic limit should be approached already at ISR energies. Finally, predictions are given for the associated moment $\langle f_2^0 \rangle n_-$, and the importance of the measurement of this quantity is emphasized. (auth)

15129 ASPECTS OF QUARK PHYSICS. Argirovic, M. Tehnika (Belgrade); 22: No. 6, 125-127(1973). (In French).

It is shown that relativistic and quantum factors can be applied to quarks. The expression for the relativistic kinetic energy of the quark shows that it is formed of three adhering particles. It is deduced that the velocity of energy propagation of the quark is higher than the phase velocity. But the particle velocity is always less than that of light. (tr-auth)

15130 MULTIPARTICLE PRODUCTIONS AND URBARYON LINES. Kinoshita, K.; Noda, H. (Kyushu Univ., Fukuoka). pp 403-422 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

The shapes and scaling properties of various inclusive reactions and the gross features of production amplitudes are investigated by considering the flow pattern of urbaryon lines as a guide. The incoming and outgoing hadrons are described by the lowest number configurations of urbaryons. The main points of arguments are the following: Interrelation between exclusive and inclusive reactions. Simple urbaryon rearrangement diagrams for inclusive reactions are related to corresponding groups of exclusive reactions, by a reduction rule of urbaryon lines. Inclusive spectra. A formula is proposed which is able to describe various shapes of single-particle distributions and their energy dependences. A generalization of the formula to two-particle ones is done. Shape parameters in the formula are related to numbers of urbaryons in certain sections of the diagram. Production amplitude. A model with three representative interactions for multiparticle productions is considered which is compatible with the reduction rule and other main features of exclusive cross sections. Energy fragmentation and hadron structure. Substantial basis of the formula for inclusive reactions is discussed in connection with the persistence of the energy carried by the constituents of incoming particles. (auth)

Electromagnetic

Refer also to abstracts 15319 and 15580.

15131 (COO-1545-147) ELECTROMAGNETIC PRODUCTION AND DECAY OF ψ(3105). Geer, K.; Mainland, G. B.; Palmer, W. F.; Pinsky, S. S. (Ohio State Univ., Columbus (USA). Dept. of Physics). 1974. Contract AT(11-1)-1545. 13p. Dep. NTIS $4.00.

The electromagnetic production and decay of the ψ(3105) meson is shown to be consistent with the vector meson dominance model and the assignment of ψ to an SU(4) $J^P = 1^-$ multiplet. (auth)

15132 (DESY-74/51) PREDICTIONS OF THE RELATIVISTIC QUARK MODEL FOR e^+e^--ANNIHILATION INTO $\omega\pi^0$. Boehm, M.; Krammer, M. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Nov 1974. 16p. Dep. NTIS (US Sales Only) $4.00.

The relativistic quark model is applied to the transition form factor between pseudoscalar and vector mesons. A generalized vector meson dominance structure is obtained which improves the ρ^0(770) dominance result and yields the decay width $\Gamma(\omega \to \pi^0\gamma) = .76$ MeV. For the cross section $\sigma(e^+e^- \to \omega\pi^0)$ $\sigma \sim 27$ nb around $Q^2 = 2.3$ GeV^2 and an asymptotic $1/Q^4$ behavior are predicted. (auth)

15133 (DESY-74/54) REMARKS ON NEW MESON STATES. Kitakado, S.; Orito, S.; Walsh, T. F. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Nov 1974. 17p. Dep. NTIS (US Sales Only) $4.00.

The production of charmed mesons in e^+e^- collisions is discussed. When mass is required it is assumed that the new state seen in $pp \to e^+e^- + X$ and $e^+e^- \to$ hadrons, $\mu^+\mu^-$ is the ϕ_c, $m_{\phi_c} = 3.1$ GeV. (JFP)

15134 (EFI-45(73)) PARTON MODEL IN ELEMENTARY PARTICLE PHYSICS. Matinyan, S. G. (Erevanskij Fizicheskij Inst. (USSR)). 1973. 52p. (In Russian). INIS.

The concept of partons (Feynman) was developed and the different effects of electromagnetic and strong interactions were discussed from this single viewpoint. The effects discussed were scaling in deep electron production, strong interaction of hadrons (elastic and inelastic), intersection $\alpha(o)$ of Regge poles, multiplicity, electromagnetic form factors, interaction of hadrons with strong transverse momenta, and final states in deep electron production and e^+e^- annihilation. The relation of the parton concept with the multiperipheral model was examined. Analogs with nuclear physics were developed, and the question of the breakdown of scaling at very high ν and q^2 is examined. (tr-auth)

15135 (FERMILAB-Conf-74/67) PRECOCIOUS SCALING AND DUALITY IN LEPTON SCATTERING AT LARGE MOMENTUM TRANSFERS AND IN ELECTRON-POSITRON ANNIHILATION. Einhorn, M. B. (Fermi National Accelerator Lab., Batavia, Ill. (USA)). Jul 1974. 24p. (CONF-740653-6). Dep. NTIS $4.25.

From 9th symposium on particle physics; Balatonfured, Hungary (12 Jun 1974).

A reformulation of the quark-parton model which can accommodate quark confinement is presented. Using duality rules familiar from hadronic interactions, it is shown that precocious scaling is a consequence of exchange degeneracy and that the Bloom-Gilman relation is related to a duality between resonances and the pomeron. In all reactions, precocious scaling is only as good as the valence quark approximation. For x sufficiently near one, precocious scaling is expected to hold for certain reactions, such as $lN \to l'X$ (where l, l' are leptons and N, a nucleon), and $e^-e^+ \to h^cX$ (where h^c is any charged hadron). It is predicted that precocious scaling will not hold, not even for x near one, in some reactions, such as $e^-e^+ \to h^0X$ [where h^0 is any nonstrange neutral meson (π^0, η, ω, ϕ)]. (auth)

15136 (HU-TFT-74-17) GAUGE INVARIANCE AND ELECTROMAGNETIC INTERACTIONS OF HADRONS. Noga, M. (Helsinki Univ. (Finland). Research Inst. for Theoretical Physics). Aug 1974. 67p. Dep. NTIS (US Sales Only) $6.50.

The algebraic realization of dynamical symmetry proposed by Weinberg is carried out for gauge symmetry of electromagnetic interactions of hadrons. The derived algebraic realization of gauge symmetry imposes strong algebraic constraints on matrix elements of the electromagnetic current and allows one to calculate electromagnetic properties of hadrons in all orders of strong interactions and in the first order in electromagnetism. Magnetic moments and partial decay rates are calculated for those baryons for which these quantities are measured, and very good agreement with experiment is found. It is also shown that the dynamical group 0(4,2) accounting for the dynamical description of the internal electromagnetic structure of hadrons is conse-

quence of the algebraic realization of gauge symmetry although it is not the only possible group. (auth)

15137 (INIS-mf-1272) ANGULAR DISTRIBUTION BEHAVIOUR IN THE PAIR ANNIHILATION AND ELECTRON–ELECTRON SCATTERING PROCESSES USING LORENTZ TRANSFORMATION. Hernandez Ch, O. L. Y. (Instituto Politecnico Nacional, Mexico City. Escuela Superior de Fisica y Matematicas). 1973. 49p. (In Spanish). INIS.

Thesis.

The angular distribution for the production of particles c in the reaction a + b = c is given as the product of an invariant quantity by a noninvariant quantity. It is through this noninvariant quantity that the angular distributions of the two inertial systems are related without having to involve the Lorentz transformation equations. The fundamental fact on which the distribution of an angular transformation is based is the invariance of production of quadrivectors which makes it possible to relate the quantities in the distinct systems. By applying these ideas of pair annihilation and using the angular distribution in the laboratory system, a valid expression is derived for any system of coordinates and particularly for calculations in the center-of-mass system. In the case of electron-electron scattering in passing from the center-of-mass system to any system, the laboratory system was particularized and the results were confirmed. (tr-auth)

15138 (INIS-mf-1568) ELECTROMAGNETIC MASS DIFFERENCES IN A RELATIVISTIC QUARKS MODEL. Escobar, C. O. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). Apr 1974. 53p. INIS.

Thesis.

The problem of mass differences existing between particles of the same isomultiplet is studied. Only the mesons are considered described by quarks relativistic model via amplitudes of Bethe–Salpeter. Also examined is the decay $\omega \to 2\pi$ which shows a relation with the problem of the electromagnetic mass differences. (auth)

15139 (KFKI-73-1) QUARK PARTON MODEL IN DEEP INELASTIC INCLUSIVE ELECTROPRODUCTION. Hasenfratz, P. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). Jan 1973. 7p. INIS.

The inclusive electroproduction of a hadron in the deep inelastic electron-proton scattering process is investigated within the framework of the quark parton model proposed by Feynman. In this picture any of the additive conserved quantum numbers of quark partons can be determined directly in terms of the experimental quantities via a sum rule. Generally the experimental test of this sum rule is very difficult but it is shown that a measurement similar to that performed at SLAC, which can not distinguish the different types of hadrons from each other and selects them only by their charges, gives the possibility to check some consequences of this sum rule. The large charge asymmetry observed in the SLAC experiment can also be explained in this quark parton model. A comparison of the theoretical predictions of this model and experimental data for the charge asymmetry is given. There is a very good agreement between theory and experiment. (auth)

15140 DUAL LIGHT-CONE MODEL PREDICTIONS FOR TOTAL AND INCLUSIVE e^+e^- ANNIHILATION. Schierholz, G. (Hamburg Univ. (F. R. Germany). 2. Inst. fuer Theoretische Physik); Schmidt, M. G. (Heidelberg Univ. (F. R. Germany). Inst. fuer Theoretische Physik). Phys. Lett., B; 52: No. 4, 467-471(28 Oct 1974).

Predictions of a recently proposed dual scaling model for the total and inclusive e^+e^- cross section are discussed with particular interest in preasymptotic corrections. Good agreement with available data is found. (auth)

15141 ON $e^+e^- \to$ HADRONS VIA FERMI INTERACTIONS. Budini, P.; Furlan, P. (Trieste Univ. (Italy). Istituto di Fisica Teorica). Phys. Lett., B; 52: No. 4, 457-460(28 Oct 1974).

In the frame of a model of finite lepton quantum electrodynamics in which regularization originates from a Fermi lepton Lagrangian, an explanation of the recent $e^+e^- \to$ hadrons experiments is proposed as a consequence of the finite size G_F of the photon and of the lepton–hadron interactions via the Fermi Lagrangian. Further experimental implications of the hypothesis are briefly outlined. (auth)

15142 VECTOR MESONS AND e^+e^- ANNIHILATION. Renard, F. M. (Montpellier-2 Univ., 34 (France). Dept. de Physique Mathematique). Nucl. Phys., B; 82: No. 1, 1-25(18 Nov 1974).

The treatment of the finite width and inelastic effects proposed previously for the ρ case is extended to the ω-ϕ case; this leads to a complex and energy-dependent mixing formalism; applications are given for $e^+e^- \to 2\pi$, 3π, $K\bar{K}$, $\pi\gamma$, $\eta\gamma$. The possible existence of ideal nonets of higher vector mesons V' and V'' is considered and their effects in the same reactions are calculated. It is shown how an infinite series of vector mesons can give an approximate constancy of the total cross section at intermediate energies and after a strong mixing, an asymptotic 1/s behavior. (auth)

15143 LIGHT-CONE AND ASYMPTOTIC BEHAVIOR OF THE ELECTROMAGNETIC AND MASS FORM FACTOR OF MESONS. Kiera, M. (Institut fuer Theoretische Physik, Lehrstuhl E, RWTH Aachen, FR Germany). Nucl. Phys., B; 82: No. 2, 323-346 (25 Nov 1974).

Within the framework of asymptotic scale invariance the light-cone structure of the hadronic matrix elements $\langle p|[\theta_{\mu\nu}(x), \phi(0)]|0\rangle$ and $\langle p|[j_\mu(x), \phi(0)]|0\rangle$ is analyzed, involving the stress tensor $\phi_{\mu\nu}(x)$, the electromagnetic current $j_\mu(x)$, some scalar field $\phi(x)$ and spinless one-particle states $|p\rangle$. Provided the off-shell Bjorken limit and the mass shell limit are interchangeable, the asymptotic behavior of the related form factors is determined by the leading light-cone singularities. Furthermore, within a naive quark model there still exists a connection between the electromagnetic and the mass form factor at high momentum transfer involving the dimension of length 1_ϕ of the meson field ϕ explicitly. By applying once-subtracted dispersion relations a sum rule for 1_ϕ is derived which may be useful in understanding anomalous dimensions. (auth)

15144 NEW LOW-ENERGY THEOREMS FOR $\gamma \to 3\pi$ AND $\gamma\gamma \to 3\pi$. Vilela Mendes, R. (Texas Univ., Austin (USA). Center for Particle Theory). Nucl. Phys., B; 82: No. 2, 213-220 (25 Nov 1974).

New low energy theorems are obtained by relaxing the requirement that the $\gamma\gamma \to 3\pi$ amplitudes vanish in the neutral soft pion limit. In the framework of a particular model it is shown that the relation $eF_{3\pi} = F_{\pi}^{-2}$ may have to be generalized to involve also the $\gamma\gamma \to 2\pi$ amplitudes. (auth)

15145 CONTRIBUTIONS OF MULTIPHOTON EXCHANGE IN ep DEEP INELASTIC SCATTERING. Bartels, J. (Hamburg Univ. (F. R. Germany). 2. Inst. fuer Theoretische Physik). Nucl. Phys., B; 82: No. 1, 172-188(18 Nov 1974).

An attempt is made, within a combined light-cone and parton approach, to estimate effects of multiphoton exchange in deep inelastic scattering. For the exchange of n photons in the Bjorken limit, contributions of the form $(1n^2Q^2)^{n-1}$ times the one-photon approximation are found. Under the assumption that they are the leading ones in each order, they can be summed up to a power-behaved function of Q^2 which modifies the structure functions $W_i(\nu, Q^2)$ in such a way that in the Bjorken limit they are no longer functions only of ω. A rough numerical estimate indicates that corrections due to multiphoton exchange become important (10% of the one-photon contribution) at about $Q^2 \sim 10^4$ GeV^2, but are always screened by the larger effect of radiative corrections at the electron vertex. They are, however, directly visible in $d\sigma(e^+p) - d\sigma(e^-p)$. (auth)

15146 STICHEL RELATIONS IN THE MUELLER-REGGE THEORY OF INCLUSIVE PHOTO- AND ELECTROPRODUCTION. Craigie, N. S.; Kramer, G. (Hamburg Univ. (F.R. Germany). 2. Inst. fuer Theoretische Physik). Nucl. Phys., B; 82: No. 1, 69-92(18 Nov 1974).

The Mueller-Regge formalism is developed for inclusive photo- and electroproduction of pions in the photon fragmentation sector. The assumptions about the analyticity of the six-point function under which one can derive a Sommerfeld-Watson representation, which involves integrals over the crossed-channel helicities, are discussed. In particular the properties of the so-called helicity-pole limit (H.P.L.) which is relevant in realizing the Mueller-Regge expansion in the fragmentation region are discussed. In the case of the four-point function there exist relations among the s-channel helicity amplitudes at high energies, if only Regge singularities of definite normality are exchanged in the t-channel (Stichel relations). One of the main points made is that in the case of inclusive distributions, these properties carry over to H.P.L. if only the leading helicity pole is taken into account. An important consequence of these relations is that the inclusive photoproduction distributions vanish as $k_T^4 \to 0(k_T$ being the transverse momentum of the pions). (auth)

15147 RADIATIVE CORRECTIONS TO THE LOW-ENERGY THEOREM FOR PSEUDOSCALAR MESON $\to 2\gamma$ IN THE WEINBERG MODEL. Frenkel, J. (Sao Paulo Univ. (Brazil). Instituto de Fisica). Nucl. Phys., B; 81: No. 3, 517-524(11 Nov 1974).

The radiative corrections to the low-energy theorem for pseudoscalar meson $\to 2\gamma$ in the unified model of electromagnetic and weak interactions proposed by Weinberg are discussed. It is

shown that, to the fourth order in the electric charge coupling constant, there are no radiative corrections. (auth)

15148 HADRON-MEDIATED PHOTON–NUCLEON INTERACTIONS. Spital, R. D. Ithaca, NY; Cornell Univ. (1974). 139p. University Microfilms Order No. 74-26,319.

Thesis (Ph. D.).

In view of the qualitative success of vector meson dominance (VMD) in explaining the general features of many hadronic photoprocesses, hadron-mediated photon-nucleon interactions clearly merit in-depth study. An attempt is made to deepen understanding of such interactions. In order to define clearly the phrase "hadron-mediated photon-nucleon interaction," old-fashioned perturbation theory is used to justify the classification of any time-ordered graph as either: type a – a direct or "bare photon" interaction, or type b – an interaction mediated by the hadronic structure of the photon (hadron-mediated interaction). (Diss. Abstr. Int., B)

15149 PHOTON AMPLITUDES PREDICTED BY THE TRANSFORMATION BETWEEN CURRENT AND CONSTITUENT QUARKS. Gilman, F. J.; Karliner, I. (Stanford Univ., CA). Phys. Rev., D; 10: No. 7, 2194-2211(1 Oct 1974).

The transformation between current and constituent quarks is discussed as it applies to real photon transitions. The general algebraic structure of such transitions is presented, and a resulting set of selection rules is derived. Many specific amplitudes for both mesons and baryons are worked out, and both their magnitudes and signs are compared with available experimental data. (auth)

15150 ELECTROMAGNETIC MASS DIFFERENCES OF HADRONS AND THE INFINITE-MOMENTUM LIMIT. Venturi, G. (Univ., Bologna). Nuovo Cim., 24A: No. 2, 121-128(16 Nov 1974).

A simple, heuristic approach to the electromagnetic energy shift of hadrons based on a dispersion relation in the virtual-photon energy is examined. Through the use of the infinite-momentum limit the different virtual-hadron contributions are separated and related to the electromagnetic mass shift. The results obtained are discussed, and it is noted that they depend explicitly on the quantum number associated with the mass difference. The method employed is analogous to that used in the infinite-momentum limit approach to light-cone sum rules and time-ordered perturbation theory for quantum electrodynamics. (auth)

15151 HIGH ENERGY e^+e^- ANNIHILATION IN UNIFIED GAUGE THEORIES. Palla, L.; Pocsik, G. (Roland Eotvos Univ., Budapest). Lett. Nuovo Cim.; 11: No. 11, 541-543(16 Nov 1974).

The total cross section of the e^+e^- annihilation into hadrons in the one-photon, Z, ϕ exchange approximation is calculated. Also the high energy contributions are discussed. (JFP)

15152 PARAMETRIZATION OF THE NEUTRON CHARGE FORM FACTOR. Zovko, N. (Univ., Karlsruhe, Ger.). Lett. Nuovo Cim.; 11: No. 11, 522-524(16 Nov 1974).

A correct parametrization formula for the neutron charge form factors as determined from the e + d elastic scattering is discussed regarding the properties it should possess. (JFP)

15153 SHORT-RANGE DOMINANCE: PREDICTIONS FOR $e\bar{e} \to$ HADRONS FROM $p\bar{p}$ DATA. Nelson, C. A. (State Univ. of New York, Binghamton). Lett. Nuovo Cim.; 11: No. 11, 517-521(16 Nov 1974).

It is inquired whether $\bar{e}e \to$ hadrons can be predicted by a simple vector meson dominance of an analog in hadronic physics, for example, of the short-range nondiffractive component of $\bar{p}p \to$ hadrons. The distinctive feature of the treatment is that predictions are expressed in terms of measured or measurable matrix elements involved in $\bar{p}p \to$ hadrons interactions. The cross section and the natural extension to predictions for charged multiplicity are investigated. (JFP)

15154 ROLES OF TRANSVERSE AND LONGITUDINAL CROSS SECTIONS IN INELASTIC ELECTROPRODUCTION OF RESONANCES. Shiga, K. (Kyushu Sangyo Univ., Fukuoka). Lett. Nuovo Cim.; 11: No. 11, 513-516(16 Nov 1974).

The total photoabsorption cross section is examined in $Q^2 = 0$ (real photon) to $Q^2 \neq 0$ (virtual photon) regions using the Rittenberg-Rubenstein scaling variable, and the transverse and longitudinal cross sections are analyzed separately. Furthermore, the dynamical difference between the cross sections for the studied resonances $\Delta(1236)$, N(1520), and N(1688) is investigated from the separate study of the transverse and longitudinal cross sections. (JFP)

15155 THE NEUTRAL PION YIELD IN THE STATISTICAL MODEL FOR e^+e^- ANNIHILATION. Engels, J.; Fabricius, K. (Bielefeld Univ. (F.R. Germany). Abt. Theoretische Physik); Schilling, K. (Physics Department, University of Wuppertal, F.R. Germany). Phys. Lett., B; 53: No. 1, 65-66(11 Nov 1974).

The decay of neutral fireballs with mass M into $\pi^+, ^-, ^0$ is considered, and the first two leading terms of the average multiplicities are derived as a function of M. The implication of this result for a statistical bootstrap description of e^+e^- annihilation into hadrons is discussed. (auth)

15156 RISE OF THE e^+e^- TOTAL CROSS SECTION RATIO AND THE PARTON-PARTON INTERACTIONS. Muta, T. (Kyoto Univ. (Japan). Research Inst. for Fundamental Physics). Phys. Lett., B; 53: No. 2, 203-206(25 Nov 1974).

An upper bound for $\sigma_{tot}(e^+e^-)$ is obtained from the unitarity bound of the parton-antiparton interactions. The bounds for various models are tested by experimental data. The $J = 1$ parton-antiparton total cross section is estimated from the data. (auth)

15157 RECIPROCAL RELATION IN ASYMPTOTICALLY FREE THEORIES. Fishbane, P. M. (Virginia Univ., Charlottesville (USA). Dept. of Physics). Phys. Lett., B; 53: No. 1, 111-113(11 Nov 1974).

Consequences of the reciprocal relation between annihilation and deep inelastic scattering are studied in asymptotically free theories. Annihilation structure functions fall with q^2 near $\omega = 1$ and rise near $\omega = 0$. Multiplicity growth lies between any power of $\ln q^2/\mu^2$ and any power of q^2/μ^2. (auth)

15158 DEPENDENCE ON k^2 OF FIXED POLE RESIDUES IN PION ELECTROPRODUCTION. Dosch, H. G. (Heidelberg Univ. (F.R. Germany). Inst. fuer Theoretische Physik). Phys. Lett., B; 53: No. 1, 109-110(11 Nov 1974).

It is shown that different mechanisms leading to fixed poles in electroproduction of pions lead to a specific difference of the k^2 dependence of the residues of these poles, k being the momentum transfer of the electrons. (auth)

15159 PHOTOPRODUCTION SUM RULES AND OPTIMAL EXTRAPOLATION TECHNIQUES. Gensini, P. (Lecce Univ. (Italy). Instituto di Fisica); Kellett, B. H. (Glasgow Univ. (UK). Dept. of Natural Philosophy); Paver, N.; Verzegnassi, C. (Trieste Univ. (Italy). Intituto di Fisica Teorica). Phys. Lett., B; 53: No. No. 2, 197-199(25 Nov 1974).

The value of photoproduction amplitudes is calculated at the interior point $v = t = 0$ using the optimal extrapolation technique of Ciulli and Fisher. The results are in fair agreement with the predictions of soft pion theory. However, the size of the errors prevents any clear-cut conclusion on "anomalous" commutators of the electromagnetic current. (auth)

15160 p-QUARK DOMINANCE AS $\omega \to 1$ IN ELECTROPRODUCTION AND DIMENSIONAL COUNTING. Scott, D. M. (Cambridge Univ. (UK). Dept. of Applied Mathematics and Theoretical Physics). Phys. Lett., B; 53: No. 2, 185-187 (25 Nov 1974).

The correspondence principle of Bjorken and Kogut used locally together with the experimental result that the ratio of the deep inelastic electron-neutron to electron-proton structure functions approaches $\frac{1}{4}$ for $\omega \sim 1$ are shown to imply in parton models that there is a class of exclusive processes which have a faster fall-off in s at fixed center of mass angle than that given by dimensional counting. (auth)

15161 DUALITY OF THE $\pi\pi$ SCATTERING AMPLITUDE. Ukawa, A.; Oyanagi, Y.; Fukugita, M. (Tokyo Univ.). pp 210-215 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

Dual structure of the $\pi\pi$ scattering amplitude was investigated in terms of the finite energy sum rule using recent phase shift data. The amplitude shows the properties quite consistent with the simple dual model in the framework of the "two component theory of duality." (auth)

15162 SHORT DISTANCE SINGULARITIES ON THE LIGHT CONE. Ng, W. C. (CERN, Geneva). pp 490-505 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

The technique of operator-product expansions is generalized to handle semi-hadronic inclusive processes like $\gamma(q) \to h(p)$ + anything and $\gamma(q) + h(p) \to h'(p')$ + anything. In contrast to the electroproduction case, the presence of a detected particle in the final state enables the coefficient of the leading light-cone singu-

larity in these processes to have additional short-distance singularity. The degree of the singularity, which is called the slant is determined in terms of the dimensions of the source operator for the detected particle for various theories. It is shown that the results confirm the necessity of modifying a purely canonical field theory. The slant singularities manifest themselves in the multiplicities of hadrons, the measurement of which therefore furnishes a means to determine experimentally the dimensions of hadronic sources. (auth)

15163 PARTON MODEL AND e^+e^- COLLIDING BEAM EXPERIMENTS. Sanda, A. I. (National Accelerator Lab., Batavia, IL). pp 517-532 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

An attempt is made to obtain a minimal set of most reasonable and general assumptions to be used in the parton model, and experimental predictions are given which critically test such assumptions. It is supposed that there is some underlying field theory which governs the hadronic physics. The bare particles in such a theory are called partons. The multiplicity and structure function scaling is considered for the process $e^+e^- \rightarrow$ hadrons + anything. (JFP)

Weak

Refer also to abstracts 15604 and 15609.

15164 (RL-74-105) CRITICAL POTENTIALS, LEPTONS, AND WEAK CURRENTS. Smith, P. F.; Lewin, J. D. (Science Research Council, Chilton (UK). Rutherford Lab.). Jun 1974. 89p. Dep. NTIS (US Sales Only) $7.50.

A theoretical study is in progress of the interaction of very strong localized electromagnetic potentials with charged leptons, and with the vacuum state. The principal objective is to investigate the phenomena which occur when the potential reaches or exceeds the critical value at which bound levels are drawn into the lower continuum. The behavior of bound and continuum solutions of the Dirac equation are examined in detail for the specific model of a short range potential well in an arbitrarily large bounded volume. Vacuum polarization effects are computed by summation over the infinite set of single particle levels, and special attention is given to the changes in magnitude and distribution of the observable charge in the vicinity of the well, as the potential strength increases through the critical value. The most significant feature of the results is the coherent displacement of the vacuum levels, equivalent to a π phase shift, which accompanies the transfer of the bound level to the lower continuum. This can be physically interpreted as an induced renormalization of the vacuum state by one charge unit, and would appear experimentally as the conversion of a lepton from a state of observable charge to a state of unobservable charge, or vice versa, in close analogy to the leptonic weak current. Thus it is suggested that this process may provide an explicit physical mechanism for the observed transition of a charged electron or muon into a corresponding uncharged (neutrino) state. A review is included of related studies of this topic for the Coulomb potential, which predict the observation of critical potential effects (specifically positron production) in high Z nuclear collisions. The new results suggest that short range critical potentials may be of wider significance, perhaps playing a crucial role in elementary particle phenomena. (auth)

15165 COMPARISON BETWEEN NEUTRINO AND ANTINEUTRINO CROSS SECTIONS AT HIGH ENERGIES FOR FIXED FINAL HADRONIC MASS. Pestieau, J.; Urias, J. (Louvain Univ. (Belgium). Inst. for Theoretical Physics). Phys. Lett., B; 52: No. 4, 425-427 (28 Oct 1974).

Under generally accepted assumptions, it is shown that, at fixed final hadronic mass, in the high-energy limit, the total cross sections for $\nu-p$ ($\nu-n$) and $\bar{\nu}-n$ ($\bar{\nu}-p$) are equal. Implications of this theorem are discussed. (auth)

15166 ARE NEUTRINOS ALWAYS LEFT-HANDED? Kayser, B.; Garvey, G. T. (National Science Foundation, Washington, D. C. (USA)); Fischbach, E.; Rosen, S. P. (Purdue Univ., Lafayette, Ind. (USA)). Phys. Lett., B; 52: No. 4, 385-388 (28 Oct 1974).

The possibility of using neutral weak interactions to see whether neutrinos may flip their helicity is explored. Experiments ranging from low-energy neutrino-nucleus scattering to high-energy inclusive reactions are discussed as tests for the presence of helicity-flipping scalar, pseudoscalar and tensor interactions. (auth)

15167 THE NATURE OF THE WEAK NEUTRAL CURRENT. Cheng, H. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Mathematics); Lo, C. Y. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Physics). Phys. Lett., B; 52: No. 4, 453-456 (28 Oct 1974).

With the conjecture that the weak neutral current should have equal status in symmetry as the other weak and electromagnetic currents, it is determined to be a pure axial-vector. This means that the weak interaction of the neutral current is parity conserving. The fundamental interactions of leptons thereby complete the whole scheme of $(1+\gamma_5)/2$, $(1-\gamma_5)/2$, 1 and γ_5. (auth)

15168 PION PRODUCTION BY FRAGMENTATION OF WEAK CURRENTS IN WEINBERG THEORY. Scharbach, P. N. (Paris-11 Univ., 91 - Orsay (France). Lab. de Physique Theorique et Hautes Energies). Nucl. Phys., B; 82: No. 1, 155-171 (18 Nov 1974).

The Feynman quark parton model is used to study inclusive single-pion production by the fragmentation of the neutral and charged weak currents of Weinberg theory. The structure functions for the neutral current-induced reactions are related to those for the electromagnetic and charged weak current processes. Analogs of inclusive deep-inelastic sum rules are derived. The ratios of neutral current to charged current cross sections for semi-inclusive pion production are studied. In the approximation of neglect of "core" partons, these ratios are given in terms of average pion multiplicities in the charged current-induced reaction. The quark parton distributions of McElhaney and Tuan are used to calculate these ratios as functions of the Weinberg angle. (auth)

15169 ELECTRON-MUON MASS RATIO, NEUTRINO MASSES AND WEINBERG ANGLE IN AN APPROXIMATE $SU(4)^+ \otimes SU(4)^-$ SYMMETRY FOR LEPTONS. Eliezer, S. (Imperial Coll. of Science and Technology, London (UK). Dept. of Physics). Phys. Lett., B; 53: No. 1, 86-88 (11 Nov 1974).

By assuming an SU(4) group for leptons together with the dynamical equation $p_z\{z \otimes z\} = 0$ (p_z is the projection of the representation z from the direct product $z \otimes z$) for the symmetry breaking, it is predicted that $m_{\nu_e} = m_{\nu_\mu} = 0$, $m_e/m_\mu \sim O(\alpha)$ and the Weinberg angle $\sin^2\theta_w = 1/4$. (auth)

15170 STRONG DUALITY AND WEAK INTERACTIONS. Dicus, D. A. (Texas Univ., Austin (USA). Center for Particle Theory); Teplitz, V. L.; Young, J. E. (Massachusetts Inst. of Tech., Cambridge (USA). Lab. for Nuclear Science). Phys. Lett., B; 53: No. 2, 177-180 (25 Nov 1974).

The possibility is investigated that weak lepton-lepton scattering satisfies duality. In particular, a Veneziano model with reasonable coupling, plausible cross sections, and sensible group structure is exhibited. Within the model neutral currents observable in ν-hadron scattering are suppressed in ν_μ-e scattering. (auth)

15171 CREWTHER'S CONSTRAINT ON ANOMALIES AND DIVERGENCE OF RADIATIVE CORRECTION TO π_{12} DECAY. Nakazawa, N.; Shimada, T.; Yamada, M. (Tokyo Univ.). pp 533-537 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

The so-called anomalies in field theories were investigated in connection with the radiative corrections to $\pi \rightarrow 2l$ decay. (JFP)

15172 STATUS OF GAUGE THEORIES OF WEAK INTERACTIONS. Lee, B. W. (New York State Univ., Stony Brook). pp 561-577 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

Various attempts to incorporate hadrons into gauge theories of weak interactions are reviewed together with the problems which arise and other developments. (JFP)

Strong (General)

15173 (BNL-19416) EXPERIMENTS STUDYING HADRON DYNAMICS MAINLY IN THE t-CHANNEL. Gordon, H. A. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 22p. (CONF-740673-4). Dep. NTIS $4.25.

From workshop on polarized targets; Upton, L. I., New York, USA (3 Jun 1974).

Some data are selected which involve the measurement of the polarization, and it is shown how these data have improved the knowledge of strong interactions. Also further experiments are

indicated. Elastic scattering, two-body reactions both nondiffractive and diffractive, a suggestion for producing exotic resonances, using polarized targets, and inclusive processes are discussed. (JFP)

15174 (NR-1421/VI/PH, pp 162-164) GENERAL FEATURES OF THE MULTIPERIPHERAL AMPLITUDES AND THE HIGH ENERGY BEHAVIOR OF THE AVERAGE MULTIPLICITY. Bassetto, A.; Sertorio, L.; Toller, M. (CERN, Geneva). 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

In order to contribute to a clarification of the situation for multiperipheral models, an attempt was made to formulate the general features which are common to all the multiperipheral models, and their direct consequences were investigated. (JFP)

15175 (NR-1421/VI/PH, pp 220-228) INCLUSIVE DISTRIBUTIONS IN THE DUAL RESONANCE AND IN THE STATISTICAL BOOTSTRAP MODEL. Satz, H. 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

It is shown that the dual resonance model as a specific dynamical description fits into the general statistical scheme proposed in the thermodynamic model. Inclusive single particle distributions are examined in both approaches, making use of the generalized optical theorem applied to the decay of hadronic systems to calculate the dual resonance model distributions. (JFP)

15176 (NR-1421/VI/PH, pp 442-489) DIFFRACTIVE PRODUCTION PROCESSES. Rushbrooke, J. G. (Cavendish Lab., Cambridge, Eng.). 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

Recent experimental developments are reviewed including factorization, helicity conservation, and double-Pomeron exchange. Recent experimental methods including the use of isotopic spin exchange analysis, the cross-over phenomenon, LPS sectoring, etc., especially in relation to diffractive slopes and mass distributions are also discussed. (JFP)

15177 (NR-1421/VI/PH, pp 500-511) PART II. TEST OF HELICITY CONSERVATION FOR THE $K^-\pi^+\pi^-$ SYSTEM DIFFRACTIVELY PRODUCED IN K^-p INTERACTIONS AT 14.3 GeV/c. Ratti, S. 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

The possible factorization of the amplitude in nondiffractive processes $\pi^+(\pi^-)p \to \pi^+(\pi^-)\pi^-\pi^+p$, $\pi^+(\pi^-)p \to \pi^+(\pi^-)\pi^+\pi^0$ and p, $\pi^+(\pi^-)p \to \pi^+(\pi^-)\pi^-2\pi^+n$ at 11.5 GeV/c is discussed. Included in the discussion are mass and momentum distributions, cross sections, and possible exchange degeneracy. (JFP)

15178 (NR-1421/VI/PH, pp 610-628) PRESENT STATUS OF THE THERMODYNAMICAL MODEL. Hagedorn, R. (CERN, Geneva). 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

The discussion of the present status of the thermodynamic model covers the statistical bootstrap of excited hadrons, kinematics added, scaling and the central plateau, multiplicities, scaling and limiting fragmentation, comparison to experiment, nonsymmetric initial states, Letessier and Tounsi improvements, and ongoing work. (JFP)

15179 ASYMPTOTIC FREEDOM: AN APPROACH TO STRONG INTERACTIONS. Politzer, H. D. (Harvard Univ., Cambridge, Mass. (USA). Lyman Lab. of Physics). Phys. Rep.; 14: No. 4, 129-180(Nov 1974).

The discovery of asymptotic freedom has opened up the possibility of extracting new sorts of detailed, dynamical consequences from a strongly interacting quantum field theory. The necessary tools—perturbation theory, the renormalization group, gauge theories, and the operator product expansion—are not new. To anyone familiar with these field theoretic approaches to strong interactions, the novel feature is a simple fact: there is a unique class of theories in which "the origin is an ultraviolet fixed point". But the consequences are so exciting that it seemed appropriate to review these ideas as they reflect on each other. Many important applications of the renormalization group and the operator product expansion to hadronic physics are omitted; the emphasis is on recent work based on asymptotically free field theories. No doubt, there are some developments so recent that they are not treated. The discussion of the basic results concerning short distance behavior is informal, but, hopefully, accurate and complete. The specific applications are treated in varying detail. (auth)

15180 QUANTUM DYNAMICS OF A MASSLESS RELATIVISTIC STRING. II. Patrascioiu, A. (Institute for Advanced Study, Princeton, N. J. (USA)). Nucl. Phys., B; 81: No. 3, 525-546(11 Nov 1974).

The massless relativistic free string is studied in the gauge $x_0 = \tau$. It is found that the classical solutions include transverse and longitudinal vibrations. The problem is treated in both the Lagrangian and Hamiltonian formalisms. Different ways of quantizing the system are investigated. The path integral quantization leads to a Poincaré invariant quantum theory in any number of dimensions. (auth)

15181 THE ELECTROMAGNETIC STRING WITH SPIN. Barut, A. O.; Bornzin, G. L. (Colorado Univ., Boulder (USA). Dept. of Physics). Nucl. Phys., B; 81: No. 3, 477-483(11 Nov 1974).

The relation between a field $F^M_{\mu\nu}$ satisfying the usual Maxwell equations and a field $F^D_{\mu\nu}$ satisfying the symmetric Maxwell—Dirac equations, and the singular potential solving both of these is given. The action principle is formulated in both forms, and the reality of the string is shown. A string with spin is constructed by placing electric charges at its endpoints. The motion and interactions of the string, the relation between flux and angular momentum quantization, and the passage to two-body Hamiltonians are examined. (auth)

15182 INTRODUCTION TO PARTICLE PRODUCTION IN HADRON PHYSICS. Humble, S. New York; Academic Press, Inc. (1974). 260p. (ISBN-0-12-361450-3).

The topics discussed are single particle production, analysis of production processes at low and intermediate energies, high energy exclusive reactions, inclusive reactions, and hadrodynamics. (JFP)

15183 UNSTABLE SYSTEMS AND MEASUREMENT PROCESSES. Twareque Ali, S. (International Centre for Theoretical Physics, Trieste, Italy); Ghirardi, G. C. Nuovo Cim.; 24A: No. 2, 220-238(16 Nov 1974).

The results of some earlier work on the time evolution of unstable quantum-mechanical systems were carried further. Under the assumption that the observation of the decay of an unstable elementary particle necessarily involves making randomly repeated localization measurements on it, leading each time to a collapse of its wave packet, certain experimentally realizable collapse processes were studied. In particular, the earlier problem of encountering infinite mean energies in the collapsed state was overcome. (auth)

15184 DEEP REGGE LIMIT OF A BILOCAL ALGEBRA OF CURRENTS. Burak, T.; Gomberoff, L.; Horwitz, L. P.; Raby, S. (Tel-Aviv Univ., Ramat Aviv, Israel). Nuovo Cim.; 24A: No. 2, 213-219(16 Nov 1974).

In a recent study of an algebra of bilocal current operators, it was shown that universality of Regge couplings follows from saturation with one-particle intermediate states in the deep Regge limit. The limiting process is re-examined from the point of view of the theory of generalized functions; the previous result is found to be rigorously correct in the framework of the hypotheses made there. (auth)

15185 INTEGRAL EQUATIONS FOR HADRONIC CORRELATION FUNCTIONS: A FUNCTIONAL-BOOTSTRAP APPROACH. Manesis, E. K. (Univ. of Chicago). Nuovo Cim.; 24A: No. 2, 143-160(16 Nov 1974).

A reasonable "microscopic" foundation of the Feynman hadron-liquid analogy is offered, based on a class of models for hadron production. An external-field formalism, abstracted from the many-body theory is introduced to describe the hadronic observables. In this formalism, the equivalence (complementarity) of the exclusive and inclusive descriptions of hadronic reactions is specifically expressed in a functional-bootstrap form, and integral equations between inclusive and exclusive correlation functions are derived. Using the latest CERN-ISR data on the two-pion inclusive correlation function, and assuming rapidity translational invariance for the exclusive one, the simplest integral equation is solved, in the "central region", and an exclusive correlation length of 1.3 units in rapidity is predicted which is in reasonable agreement with preliminary NAL four-prong results. On the basis of the same equation, an explanation is also offered for the unexpected similarity observed between $\pi^+\pi^-$ and $\pi^-\pi^-$ inclusive correlations. (auth)

15186 TWO NEW CONSERVATION LAWS IN STRONG INTERACTIONS. Vaklev, L.; Drenska, S.; Ivanov, M. (Bylgarska Akademiya na Naukite, Sofia. Fizicheski Inst. s ANEB); Nikolov, A. (Sofia Univ. (Bulgaria). Katedra po Atomna Fizika). Compt. Rend. Acad. Bulg. Sci.; 26: No. 11, 1433-1435(1973). (In Russian).

It is supposed that the hadrons are classified by the means of the relativistic physics ladders. More exactly the classification is defined by the correspondent complete sets of commuting operators. It is proved that there exists a complete set including

the operators l^2, l_3, J_3, N^2, S^2, where l, J, N and S are the angular momentum, the spin, the normal spin and the strange spin respectively. The operators of the complete angular momentum L = l + J and of the strange angular momentum M = l + S are introduced. It is shown that the operators L_3, L^2, M^2 and N^2 are commuting operators. The validity of conservation laws of M^2 and N^2 in the strong interactions when K-mesons are present is established. (INIS)

15187 THE PROBLEM OF BOUND STATES IN RELATIVISTIC FIELD THEORY AND ITS IMPLICATIONS IN THE SCALAR AND PSEUDOSCALAR GLUON MODEL FOR QUARKS. Pusterla, M. (Pontificia Universidade Catolica do Rio de Janeiro (Brazil)). Rev. Brasil. Fis.; 1: No. 3, 429-439(Dec 1971).

The study of bound states in potential theory using Padé approximants in the evaluation of the off-mass shell scattering amplitudes was proposed by Alabiso, Butera and Prosperi. In this case, the convergence of the Pade sequences is substantially enhanced. A similar method for field theoretical models aiming to the development of convenient approximations for the bound states in relativistic quark models is proposed. (INIS)

15188 THE POMERON AND THE SCALING LAW FOR PARTIAL WAVE AMPLITUDES. Haan, O.; Muetter, K. H. (Heidelberg Univ. (F.R. Germany). Inst. fuer Theoretische Physik). Phys. Lett., B; 53: No. 1, 73-76(11 Nov 1974).

From the scaling law for the s-channel partial wave amplitudes, which guarantees simultaneously t-channel unitarity at threshold $t = 4\mu^2$ and s-channel unitarity, it is found: (i) The intercept $\alpha(0)$ of the Pomeron is always one, if $\alpha(4\mu^2) > 1$. (ii) The total and the elastic cross sections are bounded from below for $s \to \infty$, $\sigma_{tot} \geq O((\log s/s_1)^{2\delta(4\mu^2)-\alpha(4\mu^2)})$, $\sigma_{el} \geq O((\log s/s_1)^{4\delta(4\mu^2)-2\alpha(4\mu^2)-1})$, where $\alpha(4\mu^2)$ and $\delta(4\mu^2)$ are the position and the type of the Pomeron singularity $(J - \alpha(4\mu^2))^{-1-\delta(4\mu^2)}$ at $t = 4\mu^2$. (iii) The type of the Pomeron singularity $\delta(4\mu^2)$ is restricted: either $\delta(4\mu^2) \leq \frac{1}{2}$ or $\delta(4\mu^2) = \alpha(4\mu^2) - \frac{1}{2}$. (auth)

15189 SUPERSELECTION RULE AGAINST THE EXISTENCE OF REAL COLOUR EXCITED STATES. Micu, L. (Institutul de Fizica Atomica, Bucharest (Romania)). Phys. Lett., B; 53: No. 1, 77-80(11 Nov 1974).

In a three triplet model the generator of the baryonic charge is supposed to receive contribution from the two hermitian commutative generators of the color group $SU(3)^c$. Consequently, the group $SU(3)^c$ cannot be used as a conventional symmetry group, its singlet representation being the single one suitable for the classification of the real hadron multiplets. (auth)

15190 IDENTICAL PARTICLE EFFECT IN AZIMUTHAL CORRELATIONS AT SMALL RAPIDITY SEPARATION. Ranft, G.; Ranft, J. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Physik). Phys. Lett., B; 53: No. 2, 188-190(25 Nov 1974).

The difference of the short range effect observed in azimuthal correlations of like and unlike particle pairs is interpreted as due to an identical and unidentical boson effect, resp., in the decay of clusters produced in the central region of hadron–hadron collisions. (auth)

15191 PREDICTION OF DOUBLE-POMERON CROSS SECTIONS FROM SINGLE-DIFFRACTION MEASUREMENTS. Chew, D. M.; Chew, G. F. (California Univ., Berkeley (USA). Dept. of Physics). Phys. Lett., B; 53: No. 2, 191-194(25 Nov 1974).

A particular case of a Mueller formula describing the absence of long-range two-particle correlations is used to predict double-pomeron cross sections from available data on single-diffraction dissociation. Although success of the formula in this application would immediately verify the double-pomeron hypothesis, the converse is not true because the formula may be invalidated by prominent low energy resonances (such as the f_0) in the pomeron-pomeron total cross section. Low statistics experiments at z = 200 and 400 GeV^2 are in order of magnitude agreement with the formula. (auth)

15192 MODELS CONCERNING THE CHEMICAL STRUCTURE OF HADRONS. Nambu, Y. (Univ. of Chicago). pp 221-236 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

A discussion is given of how to combine and superimpose the different picture of hadron physics and arrive at a synthetic picture of the chemical structure of hadrons. This name implies an assumption that it is meaningful to talk about the substructure of hadrons and this without the backing of a precise mathematical theory. (JFP)

15193 REALISTIC THEORY OF RELATIVISTIC STRING AND SUPER-WAVE EQUATION. Takabayasi, T. (Nagoya Univ., Japan). pp 237-271 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

The classical foundation of the theory of relativistic string (taken as a model of hadrons) and its quantization are analyzed. One distinguishes between "geometric approach" and "realistic approach" and clarifies the relation between both. It is shown that the latter approach provides a more general framework because it allows a relativistic string with intrinsic "parton" mass. Also the generalization of the model by the association of Fermi or parafermi oscillators to the string is considered. (auth)

15194 ELECTROMAGNETIC INTERACTION IN THE STRING MODEL. Goto, T.; Naka, S. (Nihon Univ., Tokyo). pp 275-282 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

Following the idea that it may be more convenient to consider charge density as a q-number for the consideration of the Virasoro algebra in the formulation of the string model, a simple example of the string model is presented which is gauge invariant and contains a consistent Virasoro algebra without any restriction to the external electromagnetic potential. One does not seriously take care of obtaining a dual amplitude. (JFP)

15195 VISUAL SURVEY OF SHAPE AND STRUCTURE OF DUAL RESONANCE PARTICLES. Matsuda, S. (Kyoto Univ.). pp 283-296 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

A visual survey is made of the shape and structure of dual resonance particles of the string model through their photon coupling. The study is based on a previous electromagnetic interaction. (JFP)

15196 HADRON REACTIONS AND URBARYON REARRANGEMENT. Ghoroku, K. (Kyushu Univ., Fukuoka); Imachi, M.; Otsuki, S.; Toyoda, F. pp 361-382 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

Recent results on urbaryon rearrangement approach in composite hadron reactions are given: S channel resonant amplitudes obtained from correlated resonances at the impact parameter $b_0 \sim 5/GeV$ and their application to forward and backward meson-baryon reactions. Breaking in line reverse reactions and a problem of exotics. An over-all similarity between meson-baryon and baryon (antibaryon)–baryon reactions. U(6) baryon spectrum and U(6) breaking mechanisms connected with roles of the urbaryon spin in its rearrangement. (auth)

15197 UNIVERSAL URBARYON REARRANGEMENT INTERACTION. Matsuoka, T. (Nagoya Univ., Japan). pp 383-390 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

From the viewpoint of the urbaryon rearrangement, the concept of universal urbaryon rearrangement interaction is introduced, which retains the countable nature of constituent urbaryon free from the coexistence of d-type coupling with f-type one. The results derived from the concept are in good agreement with experimental data. (auth)

15198 MULTIPLICITY DISTRIBUTION MODEL IN HIGH ENERGY HADRONIC COLLISIONS. Yokoyama, K. (Hiroshima Univ.); Minakata, H.; Namiki, M. pp 424-429 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

In order to describe correlations among produced particles, some multiplicity distribution model is presented. The distribution can be derived from some kind of cluster assumptions for produced particles, and it corresponds to a modified Polya distribution in which two parameters are included besides the averaged multiplicity. (JFP)

15199 POSSIBLE EXPLANATION OF INCLUSIVE SPECTRA AT LARGE TRANSVERSE MOMENTUM. Sakai, S. (Tokyo Univ. of Education). pp 439-446 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

An equation for inclusive cross sections was derived on the basis of a multiperipheral-type model. The data on the k_T distribution in the small-x region were fit. (JFP)

15200 GEOMETRICAL DESCRIPTION OF THE STRUCTURE OF THE HADRONS. Yang, C. N. (New York State Univ., Stony Brook). pp 629-634 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

A lecture is given on a review of the most important experimental evidence on the geometrical description of the structure of a hadron. Elastic scattering limiting fragmentation, possible spin correlation, and a possible measurement of the velocity profile are discussed. (JFP)

Strong (Baryon No. = 0)

15201 (COO-1764-205) SEARCH FOR CHARM. Gaillard, M. K.; Lee, B. W.; Rosner, J. L. (National Accelerator Lab., Batavia, Ill. (USA); Minnesota Univ., Minneapolis (USA)). Aug 1974. 48p. Dep. NTIS $5.50.

A systematic discussion of the phenomenology of charmed particles is presented with an eye to experimental searches for these states. An attempt is made to clarify the theoretical framework for charm. Then the SU(4) spectroscopy of the lowest lying baryon and meson states, their masses, decay modes, lifetimes, and various production mechanisms are discussed. Also a brief discussion of searches for short-lived tracks is presented. The discussion is largely based on intuition gained from the familiar—but not necessarily understood—phenomenology of known hadrons, and predictions must be interpreted only as guidelines for experimenters. (auth)

15202 (DESY-74/50) IS VECTOR DOMINANCE STILL ALIVE? Schildknecht, D. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F.R. Germany)). Nov 1974. 34p. Dep. NTIS (US Sales Only) $4.75.

The lecture on some new results recently obtained within the framework of the off-diagonal generalized vector dominance covers ρ^0, ω, ϕ dominance and hadronlike behavior of the photon, generalized vector dominance: the diagonal model and its problems, generalized vector dominance: a model with inclusion of off-diagonal transitions, recent e^+e^- annihilation data implying possible violations of scaling in deep inelastic electron scattering, and vector meson electroproduction off-diagonal transitions as a model for photon shrinkage. (JFP)

15203 (DESY-74/52) MASSES AND LEPTONIC DECAY WIDTHS OF NEW VECTOR MESONS. Boehm, M.; Krammer, M. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Nov 1974. 7p. Dep. NTIS (US Sales Only) $4.00.

The recurrences of the "3105" and the leptonic decay widths are predicted with the help of the relativistic quark model, by making the dynamical conjecture that the scale is set by the zero point energy of "3105". (auth)

15204 (IPNO-T-74-09) SOME ASPECTS OF THE RELATIVISTIC THREE-BODY PROBLEM. Pasquier, R. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Dec 1973. 202p. (In French). Dep. NTIS (US Sales Only) $13.25.

Thesis.

The relations between two and three body amplitudes involved in this problem are examined within different frameworks. Khuri-Treiman equations are first used to show that the consistency between unitarity properties of these amplitudes demands non-analytic extension out of their definition domain. On another hand, numerical resolution of the same equations allows one to interpret the ω and A_1 mesons as rho π resonant states and at the same time reveals an important threshold effect for the A_1. New results concerning the validity of integral representations and polynomial expansions of decay amplitudes are then obtained within the framework of perturbation theory. Bethe-Salpeter equations allow one moreover to compare the content of the usual three-body approaches and to exhibit some results independent of the associated approximations. The threshold behavior of the Fredholm determinants is one of such results; its study leads to predictions in good agreement with experiment. (auth)

15205 (PUC-TN-1/74) KAON NONLEPTONIC DECAYS AND CHIRAL SYMMETRY BREAKING. McNamee, P. C.; Scadron, M. D. (Pontificia Universidade Catolica do Rio de Janeiro (Brazil). Instituto de Fisica). Mar 1974. 36p. INIS.

A consistent formulation of current algebra and pion PCAC is given for the kaon nonleptonic weak decays $K \to 2\pi$ and $K \to 3\pi$. This includes evaluation of kaon σ terms and $\Delta I = 1/2$ and $\Delta I = 3/2$ contributions to the weak current–current Hamiltonian. A large meson σ term, σ_{KK}, apparently is necessary to explain the $K_{2\pi}$ and $K_{3\pi}$ measured decay parameters. The hyperon nonleptonic decays are then re-examined and also shown to be compatible with a large value for σ_{KK}. Implications for the $(3,\bar{3})$ chiral symmetry breaking model and for octet dominance of the weak Hamiltonian are then proposed. (INIS)

15206 (PUC-TN-2/74) RESOLUTION OF THE $\eta \to 3\pi$ PUZZLE IN THE $(3,\bar{3})$ MODEL. McNamee, P. C.; Scadron, M. D. (Pontificia Universidade Catolica do Rio de Janeiro (Brazil)). Mar 1974. 11p. INIS.

By including a u_3 term in H_{EM} and taking into account rapidly varying meson poles, it is shown that the nonvanishing $\eta \to 3\pi$ amplitude is consistent with pion PCAC and current algebra. (auth)

15207 EIKONAL APPROXIMATION FOR SCATTERING AMPLITUDES WITH AN APPLICATION TO UNSTABLE PARTICLE DECAY. Goldman, C. University Park, PA; Pennsylvania State Univ. (1974). 125p. University Microfilms Order No. 74-28,957.

Thesis (Ph. D.).

One may expect the eikonal approximation to be valid in treating the final state interactions among the decay products of an unstable particle with effective rest energy much larger than the sum of the rest energies of the decay products. An obvious candidate would be the decay $f(1270) \to \pi + \pi$, but the decay $(770) \to \pi + \pi$ may also be in the ball park. The application of the Blankenbecler–Goldberger form of the eikonal amplitude to the decay amplitude is developed. In the process an off energy shell and nonvanishing spin generalization of the eikonal amplitude is constructed. Calculations of the enhancement of the decay amplitude in the presence of various potential interactions between decay products are presented. (Diss. Abstr. Int., B)

15208 STUDY OF THE ROY EQUATIONS. I. Analyticity, Crossing and Threshold Behavior. Atkinson, D.; Pool, T. P. (Rijksuniversiteit Groningen (Netherlands). Instituut voor Theoretische Natuurkunde). Nucl. Phys., B; 81: No. 3, 502-516 (11 Nov 1974).

The pion dispersion relations of Roy are studied critically, and it is shown that they lead in general to incorrect threshold behavior for the higher partial-wave amplitudes. The equations are modified in order to cure this disease, but at the expense of a reduced domain of convergence. The new equations of Mahoux, Roy and Wanders are found to be free from the difficulty; and they are cast into a form reminiscent of the Cini–Fubini representation. (auth)

15209 RENORMALIZABLE MASSIVE VECTOR-BOSON THEORIES WITH DISTORTED LOCAL GAUGE SYMMETRY. Hsu, J. P. (Univ. of Texas, Austin). Lett. Nuovo Cim.; 11, 525-529(16 Nov 1974).

A formal foundation is given for general renormalizable massive vector-boson theories with distorted local gauge symmetry. A Lagrangian involving massless vector and scalar fields is considered. (JFP)

15210 SEARCH FOR BACKWARDS-PRODUCED EXOTIC MESON RESONANCES IN 8.4 GeV/c π^+p INTERACTIONS. Alam, M. S.; Brabson, B. B.; Galloway, K.; Mercer, R. (Indiana Univ., Bloomington (USA)); Baggett, N. V.; Fowler, E. C.; Huebschman, M. L.; Kreymer, A. E. (Purdue Univ., Lafayette, Ind. (USA)); Rogers, A. H. (Stanford Linear Accelerator Center, Calif. (USA)); Baglin, C. Phys. Lett., B; 53: No. 2, 207-211(25 Nov 1974).

Results are reported from a hybrid experiment designed to search for backwards-produced charge = +2 exotic meson resonances by investigating the reaction $\pi^+ + p \to X^{++} +$ n(forward) at 8.4 GeV/c. The data reported correspond to approximately 30 events per microbarn. No clear evidence for narrow exotic mesons was found for masses ≤ 3.0 GeV in the decay modes accessible for study which included: $X^{++} \to \pi^+\pi^+$, $\pi^+\pi^+\pi^+\pi^-$, $\pi^+\pi^+\pi^+\pi^+\pi^-\pi^-$, and $\bar{p}p\pi^+\pi^+$. (auth)

15211 COMMENT ON THE DUALITY STUDY OF THE $\pi\pi$ SCATTERING FROM THE VIEW POINT OF THE ZEROS OF THE $\pi\pi$ AMPLITUDES. Shimada, T. (Tokyo Univ.). pp 216-218 of

Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

Comments are made on the duality study of $\pi\pi$ scattering from the viewpoint of the zeros of the $\pi\pi$ amplitudes. The so called anomaly of the $\pi\pi$ scattering is resolved by considering the role of the zeros precisely. Elastic scattering is considered. (JFP)

15212 PROPERTIES OF THE UNNATURAL PARITY MESON TRAJECTORIES. Bando, M. (Kyoto Univ.). pp 297-312 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

The Regge parameters of unnatural parity mesons (UPM) are discussed in positive and negative mass regions. Problems investigated are: The slope of the Regge trajectory of π-B series; Exchange degeneracy (EXD) between the trajectories and residues of π and B; The dual nature of the contribution of UPM. (auth)

15213 INCLUSIVE K/π PRODUCTION RATIO IN THE CENTRAL REGION. Yazaki, S. (Tokyo Univ.). pp 434-438 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

The K/π ratio of the inclusive reaction at small values of emitted particle momentum in the center of mass frame at the central region. The approach is based on the generalized f, f' coupled pomeron model which is successfully applied to hadronic diffraction phenomena. (JFP)

Strong (Baryon No. = 1)

Refer also to abstracts 15272 and 15586.

15214 (CEA-N-1709) ANALYTICAL PROPERTIES OF INVARIANT SCATTERING AMPLITUDES AND DISPERSION RELATIONS. Dronkers, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Physique des Particules Elementaires). Mar 1974. 104p. (In French). Dep. NTIS (US Sales Only) $8.25.

The practical application of fixed-transfer dispersion relations in meson-baryon scattering is considered. A short survey is given of some elementary mathematical properties of analytic functions of one complex variable. The analytical properties of the invariant scattering amplitudes are then established. It is shown how to find the regions of analyticity with respect to the energy and transfer variables, and the situation of the different singularities; special attention is paid to the computation of the pole residues. Dispersion relations and sum rules are derived for πN and KN scattering with a discussion about the practical use of the information they supply. Finally a class of functions is constructed which satisfies the dispersion relations; such functions may be used for the parametrization of the scattering amplitudes. (auth)

15215 (FRNC-TH-498) DEVELOPMENT OF NEW METHODS FOR THE ANALYSIS OF TWO-BODY REACTIONS: $\frac{1}{2} + 0$. Urban, M. (Paris-11 Univ., 91 - Orsay (France)). 1973. 169p. (In French). Dep. NTIS (US Sales Only) $11.50.

Thesis.

A critical study of phase shift analyses is given for a precise physical example: K^+p elastic scattering. Six irreducible defects were shown. Zerology, used for this criticism, proved suitable for this physical example in spite of the absence of near zeros and a mathematical optimization of the zero estimators was developed. A conformal transformation adapted to zerology was established. The exact limits of this type of method were also defined from a computerized simulation of scattering experiments, by drawing at random. The statistical problem of obtaining the density of probability of the roots of a polynomial when that of the coefficients is given was rigorously resolved. As a result it was possible to predict and explain unexpected phenomena in the behavior of the zeros and correct the estimators. On the basis of the experimental $K^+p \to K^+p$ data the zeros of the reaction were estimated at several energies. Polar adjustments show that two poles close to ρ and Λ^0, not proving the usual analyticity hypotheses, perfectly approximate the K^+p data. Finally arguments are given against the formation of exotic resonances in K^+p below 2 GeV/c. (auth)

15216 (INIS-mf-958) RISING CROSS SECTIONS AND SCALING. Caprasse, H.; Burnel, A. (Liege Univ. (Belgium). Faculte des Sciences). 1973. 23p. INIS.

A parametrization for total cross sections, which incorporates a logarithmically rising term is proposed. The new parameters present in it are restricted using a scaling assumption for q^2 in the time-like region. The resulting expression contains only one parameter in addition to the usual Regge parameters. In the energy range between 10 and 400 GeV/c, this model gives very good fits for $\pi^\pm p$, $K^\pm p$, pp and $\bar{p}p$ total cross sections. Above 400 GeV/c, the agreement with recent data on pp total cross section is only qualitative. The model also predicts the vanishing of the ratio of real to imaginary parts of the pp forward elastic amplitude at 360 GeV/c in agreement with experimental data, the increase of this ratio to a maximum value and a vanishing asymptotic limit. (auth)

15217 (IPNO-T-74-07) STUDY OF THE $\pi^-p \to \pi^0n$ AND πN BACKWARD DIFFUSION IN THE FRAMEWORK OF FIXED POLES AND SHIELDING CUTS IN THE ANGULAR MOMENTUM PLANE. Zaoui, R. (Paris-11 Univ., 91-Orsay (France). Inst. de Physique Nucleaire). 1974. 79p. (In French). Dep. NTIS (US Sales Only) $7.00.

Thesis.

An analysis of the πN backward and forward charge exchange amplitude is made in the framework of fixed poles and shielding cuts. It is assumed that wrong signature fixed poles are present in the amplitude. The analytic structure implied by unitarity which allows the fixed pole to be present without any contradiction with the unitarity relation is determined. The phenomenological implications of such a model in the dip bump structure of the πN backward scattering and $\pi^-p \to \pi^0n$ charge exchange is investigated. The model provides a good description of the data on backward $\pi^\pm p$ at 6 and 10 GeV/c, including the differential charge exchange cross section in the backward and forward direction and the polarization observed at 6 GeV/c. (auth)

15218 (ITF-73-62-E) STATISTICAL ASPECTS OF THE NEVEU-SCHWARZ DUAL MODEL. Gorenshtein, M. I.; Shelest, V. P.; Sitenko, Yu. A.; Zinov'ev, G. M. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1973. 16p. INIS.

The statistical method is applied to Neveu and Schwarz model for obtaining the average characteristics of the heavy resonances: spin distribution, decay widths, etc. The properties of the dual model spectrum of states constructed only of anticommuting operators are also considered. In this case the spin characteristics coincide with the results of the statistical bootstrap model. (auth)

15219 (LBL-2098) ALMOST EVERYTHING ABOUT BARYON RESONANCES. Rosenfeld, A. H. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jul 1973. Contract W-7405-eng-48. 37p. (CONF-740731-3). Dep. NTIS $5.00.

From international school of subnuclear physics; Erice, Italy (14 Jul 1974).

The review of Argand diagrams for baryon resonances includes the recent doubling of information, partial-wave analysis of $\pi N \to N\pi\pi$, energies, elastic partial waves, counting and naming the waves, checks of the LBL/SLAC programs, results for Argand diagrams, comparisons of $\pi N \to \rho N$ and $\gamma p \to \pi N$ with the quark model, SU(3) tests for $\pi N \to \Delta\pi$ and $KN \to \Sigma(1385)\pi$, comparison of $\Delta\pi$ amplitudes with SU(6) and the quark model, estimating resonance parameters by eye without a K matrix, multichannel K-matrix fits, Breit-Wigner refit to K-matrix fits, and a comparison of different resonance parametrization. (JFP)

15220 (NR-1421/VI/PH, pp 81-93) LONGITUDINAL PHASE SPACE ANALYSIS OF $\pi p \to p5\pi$ REACTION. Wroblewski, A. 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

For the longitudinal phase space analysis of the $\pi p \to p5\pi$ reaction, there are six independent experiments combined. Regularities of the data, six-body channels, LPS sector improvement of the resonance to background ratio, the mass spectrum, and a comparison between different multiplicities are discussed. (JFP)

15221 (NR-1421/VI/PH, pp 94-97) HOW WELL DOES AN LPS ANALYSIS SEPARATE PRODUCTION MECHANISMS IN $\pi^+ + p$ INTERACTIONS AT 8 AND 16 GeV/c? Bossen, G. (Aachen-Berlin-Bonn-CERN-Heidelberg Collaboration). 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

The LPS analysis is performed for the reaction $\pi^+p \to 2\pi^+p\pi^-$. The analysis can be restricted to four sectors parametrized by x_+ and x_-. Wrong mass distributions in strips along the sector borders are investigated to check more carefully if overlap from one sector into another exists. Dissociation and cross sections are noted. There are A_1, A_2, A_3, ρ^0, and f^0 signals. (JFP)

15222 (NR-1421/VI/PH, pp 147-151) LONGITUDINAL DISTRIBUTIONS OF THE NET CHARGE IN π^+p INTERACTIONS AT

8 GeV/c. Loskiewicz, J. (Aachen-Berlin-CERN-Cracow-Warsaw Collaboration). 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

In the π^+p interactions the charge of the initial state is equal to two, hence the produced particles show a net charge of the same value. It is of interest to know how this charge is distributed along the longitudinal direction. The change of the inclusive dQ/dx distribution as a function of multiplicity is discussed. The mechanism responsible is considered to be correlations and their charge dependence. (JFP)

15223 (NR-1421/VI/PH, pp 158-161) LONGITUDINAL DISTRIBUTIONS OF THE NET CHARGE IN π^+p INTERACTIONS AT 8 GeV/c. Wang, L. L. (Brookhaven National Lab., Upton, NY). 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

The diffractive inclusive cross sections for $\pi^-p \to pX^-$ interactions at 25 and 40 GeV/c was recently measured as a function of missing mass. It is pointed out that the cross section exhibits approximate scaling in s^1/s and that a small nonscaling term is also present. (JFP)

15224 (NR-1421/VI/PH, pp 404-414) CORRELATIONS BETWEEN PION PAIRS FROM K^+p INTERACTIONS. Bialas, A. 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

A definition of the correlation function for pion pairs in K^+p interactions is given. It is emphasized that there are normalization factors $1/\sigma$. These factors guarantee that the quantities entering this formula are normalized to one event. (JFP)

15225 (NR-1421/VI/PH, pp 415-419) CORRELATIONS BETWEEN PION PAIRS FROM K^+p INTERACTIONS. Petersson, B. 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

A discussion is given of a previous phenomenological treatment of the inclusive quantities in K^+p interactions, somewhat in contrast to the formal use of Mueller's optical theorem + Regge pole saturation. An integral equation is presented for the one-particle distribution. (JFP)

15226 (NR-1421/VI/PH, pp 490-491) PART I. Tests of S and T-Channel Helicity Conservation in $(p\pi^+\pi^-)$, $(K^-\pi^+\pi^-)$, and $(\pi^+\pi^+\pi^-)$ Production in 16 GeV/c π^+p and 10 GeV/c K^-p Interactions. Salmeron, R. (Aachen-Berlin-Bonn-CERN-Cracow-Heidelberg-London-Vienna-Warsaw Collaboration). 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

Necessary conditions for s- and t-channel helicity conservation are tested for $(p\pi^+\pi^-)$, $(K^-\pi^+\pi^-)$, and $(\pi^+\pi^+\pi^-)$ states produced in 16 GeV/c π^+p and 10 GeV/c K^-p interactions by means of a method which is independent of specific spin-parity assignments to the states. (JFP)

15227 (NR-1421/VI/PH, pp 492-496) PART II. Test of Helicity Conservation for the $K^-\pi^+\pi^-$ System Diffractively Produced in K^-p Interactions at 14.3 GeV/c. Barloutaud, R.; Borg, A.; Salmeron, R. A. (Rutherford-Ecole Polytechnique-Saclay Collaboration). 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

Using a method independent of spin-parity analysis helicity conservation in the s and t channel is tested for the diffractive production of the $K^-\pi^+\pi^-$ system in K^-p interactions at 14.3 GeV/c. Scatter plots are shown, and it is concluded that the data are definitely at variance with either s- or t-channel helicity conservation for $K\pi^-\pi$ masses $\leq$ 2 GeV. (JFP)

15228 (NR-1421/VI/PH, pp 629-645) SOME FEATURES OF TRANSVERSE MOMENTUM DISTRIBUTIONS IN INCLUSIVE REACTIONS. Lestienne, R. (Bonn-Durham-Nijmegen-Paris (E.P.)-Torino Collaboration and Rutherford-Ecole Polytechnique-Saclay Collaboration). 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

One- and two-particle inclusive reactions are reported for which p_T^2 distributions and a statistical approach for the p_T distribution are considered. An attempt is made to interpret the single p_T distributions of $\bar{K}^0$, Λ, π^+, and π^- separately. K^-p and π^+p interactions are considered. (JFP)

15229 OFF-SHELL EXTENSION OF THE π-NUCLEON TRANSITION MATRIX AND SEPARABLE π-NUCLEON POTENTIALS. Schmit, C. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Phys. Lett., B; 52: No. 4, 381-384 (28 Oct 1974).

The off-shell extension of the P-wave π-nucleon transition matrix given by the Chew-Low model is compared with the one obtained from a separable potential. It is shown that the two off-shell extensions are rather different; π-deuteron scattering results are compared for the two cases. (auth)

15230 AMPLITUDES FOR ρ AND A_2 REGGE EXCHANGES IN Δ PRODUCTION PROCESSES. de Brion, J. P. (Rochester Univ., N. Y. (USA)); Peschanski, R. (European Organization for Nuclear Research, Geneva (Switzerland)). Nucl. Phys., B; 81: No. 3, 484-501 (11 Nov 1974).

In Δ production processes like $\pi^+p \to \pi^0\Delta^{++}$, $\pi^+p \to \eta\Delta^{++}$, $K^+p \to K^0\Delta^{++}$, $K^-n \to \bar{K}^0\Delta^-$, exchange degeneracy breaking between ρ and A_2 Regge poles is shown to be present in all s-channel helicity amplitudes including the double-flip one. Once the dominance of two among four amplitudes and SU(3) invariance are assumed, the amplitudes are obtained in a rather model-independent way. The peculiar feature of these amplitudes are analyzed, and in particular some evidence for universality in the impact parameter representation is pointed out. Possible explanations are proposed. (auth)

15231 AMPLITUDE ANALYSIS OF KAON-NUCLEON SCATTERING DATA. Dronkers, J.; Kroll, P. (Karlsruhe Univ. (TH) (F.R. Germany). Inst. fuer Theoretische Kernphysik). Nucl. Phys., B; 82: No. 1, 130-146 (18 Nov 1974).

The KN scattering amplitudes were extracted from experimental data in the energy range $3 \lesssim k \leq 14$ GeV/c and for transfer values between -0.05 and -0.6 GeV^2. The ω and P+f helicity-flip amplitudes and the A_2 helicity nonflip amplitude were neglected; it is shown, that these simplifications are compatible with the data and have no significant influence on the results. One needs to assume the approximate validity of SU(3) symmetry for the ρ and A_2 couplings. A very important constraint for this analysis comes from recent experimental data for the reaction $K_L^0p \to K_S^0p$. The results for A_2 and ω exchanges are analyzed as functions of momentum transfer and energy and several current theoretical ideas are tested. Information about f-exchange is also obtained when some further assumptions are made concerning SU(3) symmetry and duality at $t = 0$. Extrapolating the amplitudes to $t = 0$ a comparison is made with dispersion relation calculations; at other t-values comparisons are made with results obtained from finite energy sum rules and other analyses based on fixed t analyticity. The predictions for KN data which have not been considered in this analysis are shown to be in good agreement. One of the results is that the ρ-ω universality rule is approximately satisfied; a strong indication for a peripheral behavior of the imaginary part of the nonflip f-exchange amplitude is also found. (auth)

15232 DETERMINATION OF THE REAL PARTS OF THE $K^{+-}p$ FORWARD SCATTERING AMPLITUDES AND A REDUCED KNY COUPLING CONSTANT CONSISTENT WITH DISPERSION RELATIONS. Cruz, A.; Mabres, A. (Zaragoza Univ. (Spain). Facultad da Ciencias). Nucl. Phys., B; 82: No. 2, 347-364 (25 Nov 1974).

A type of modified dispersion relation and an iterative procedure are introduced, which allow the self-consistent determination of the real parts of the forward $K^{\pm}p$ scattering amplitude. The free parameters, which are determined by a linear fit in which all available data enter on real and imaginary parts, are the real and imaginary parts of the amplitude in an arbitrary point of the complex energy plane. Particularly taking the point at one of the poles, the value of the residue and that of the derivative of the residue function at that point are calculated. By this procedure, a correlation is found between a reduced coupling constant $\bar{G}^2/4\pi = G_1^1/4\pi + 0.6\, G_3^1/4\pi$ and the s-wave K^+p scattering length a_s^1, the relation $\bar{G}^2/4\pi = -253a_s^1 - 59.83$ being obtained. Using a version of the dispersion relation, a value $a_s^1 = -0.296$ fm is determined, which yields $\bar{G}^2/4\pi = 15.12$. Simultaneously the real parts over a wide range of energies are determined. The independence of the calculations with respect to the parametrization used for the imaginary part of the amplitude in the unphysical region is illustrated. (auth)

15233 FORM FACTORS AND STRUCTURE FUNCTIONS OF HADRONS IN THE NON-LOCAL QUARK MODEL. Sogami, I. (Kyoto Sangyo Univ. (Japan). Dept. of Physics); Werle, J. (Warsaw Univ. (Poland). Instytut Fizyki Teoretycznej). Phys. Lett., B; 53: No. 1, 81-85 (11 Nov 1974).

The form factor of dipole type and the structure function with the threshold behavior $(1 - x')^3$ are derived for the proton in the non-local quark theory where deeply bound quarks are assumed in the relative motion of characteristic harmonic oscillation. (auth)

15234 PHASE SHIFTS FOR K^+-PROTON SCATTERING WITH STRONG p-WAVES AT LOW ENERGIES. Ferreira, E. (Pontificia Universidade Catolica do Rio de Janeiro (Brazil)); Thome, Z. D.; Rosa, L. P. (Rio de Janeiro Univ. (Brazil)). Rev. Brasil. Fis.; 1: No. 3, 381-401 (Dec 1971).

A solution for the phase shift analysis of K^+p scattering at low energies which is characterized by large p-wave and small s-wave phase shifts is presented and discussed. (INIS)

15235 THE CHARGE RADIUS OF THE NEUTRON AND THE QUARK–PARTON MODEL. Sehgal, L. M. (Technische Hochschule Aachen (F.R. Germany). 3. Physikalisches Inst.). Phys. Lett., B; 53: No. 1, 106-108 (11 Nov 1974).

An attempt is made, within the framework of the quark–parton model, to understand the negative sign of $\langle R^2\rangle_n$, the mean square charge radius of the neutron. An hypothesis is made concerning the transverse momentum distribution of partons that is motivated by recent measurements on electroproduction. With this hypothesis, the result $\langle R^2\rangle_n < 0$ implies the inequality $\sigma^{\nu N} - \sigma^{\bar{\nu}N} > 6 \int (F_2^{ep} - F_2^{en})\, dx$ (σ's in units of G^2ME/π), which appears to be in agreement with present data. (auth).

15236 AN INTERIOR DISPERSION RELATION DETERMINATION OF THE πN SIGMA-TERM. Hite, G. E. (Trier-Kaiserslautern Univ., Kaiserslautern (F.R. Germany). Fachbereich Physik); Jacob, R. J. (Arizona State Univ., Tempe (USA). Dept. of Physics). Phys. Lett., B; 53: No. 2, 200-202 (25 Nov 1974).

The importance of the pion-nucleon σ-term in the study of chiral symmetry breaking models has been discussed thoroughly in the literature. A model-independent dispersion relation method of determining the σ-term is presented, which is completely different from dispersion relation approaches used previously and has several distinct advantages. As a consequence, the result for the σ-term serves as an independent check on previous calculations. The value of the πN σ-term is determined to be $\sigma_{\pi N} = 68$ MeV. (auth)

15237 COMPATIBILITY OF OLD AND NEW πN CHARGE-EXCHANGE RESULTS. Barger, V. (Wisconsin Univ., Madison (USA). Dept. of Physics); Phillips, R. J. N. (Science Research Council, Chilton (UK). Rutherford Lab.). Phys. Lett., B; 53: No. 2, 195-196 (25 Nov 1974).

Results for $d\sigma/dt$ ($\pi^-p \to \pi^0n$) for 5 to 18 and 20 to 101 GeV/c, from CERN and FNAL respectively, are compatible with a single set of ρ-Regge pole parameters, contrary to first appearances. These data are simultaneously fitted to a $\rho + \rho'$ parametrization, together with polarizations, cross sections differences $\Delta\sigma_t = \sigma_t(\pi^-p) - \sigma_t(\pi^+p)$, and continuous moment sum rules. A small discrepancy with $\Delta\sigma_t$ remains, possible to systematic error or a ½% charge-symmetry breakdown. (auth)

15238 PERIPHERAL ORBIT MODEL. Hara, Y.; Kuroda, T.; Takaiwa, Y. (Tokyo Univ. of Education). pp 200-209 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

The peripheral-orbit model is discussed and applied to $K^-p \to K^-p$ and $K^-p \to K^0n$ processes to reproduce the differential cross sections. (JFP)

15239 CROSSING INVARIANT SOLUTION OF BARYON EXCHANGE DEGENERACY AND REGGEON F/D RATIOS. Eguchi, T. (Tokyo Univ.). pp 315-322 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

Progress is reported on previous attempts at a construction of crossing invariant solutions of baryon exchange degeneracy using consideration of the eigenvectors of SU(3) crossing matrices obtaining an s, u crossing even solution by an appropriate combination of $\tau P = +$ and $\tau P = -$ exchange degeneracy pairs. It is pointed out that there exists an essentially unique solution of baryon exchange degeneracy which closes under s, u crossing within the framework of SU(3) and no exotics in all channels. It is shown that this solution having realistic values for the octet F/D ratios of baryon couplings into meson–baryon and Reggeon couplings into baryon–antibaryon. It predicts the Reggeon F/D values for s channel helicity nonflip and flip amplitudes very close to experimental values. (JFP)

15240 SU(3)-SYMMETRIC DUAL MODEL FOR MESON–BARYON SCATTERING BASED ON CROSSING INVARIANCE. Igi, K. (Brookhaven National Lab., Upton, NY). pp 323-337 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

An SU-3 symmetric dual model for meson–baryon scattering based on crossing invariance as first step to construct a kind of dual model which explains the meson–baryon scatterings in all angles for all energies is discussed starting by finding the finite-energy sum rules bootstraps solution for meson–baryon scattering. Restriction is made to the pion–nucleon case. It is believed that this approach will be useful for the investigation of all the meson–baryon scattering and baryon–antibaryon annihilation into two mesons. (JFP)

Strong (Baryon No. ≥ 2)

Refer also to abstract 15312.

15241 (NR-1421/VI/PH, pp 59-80) ISOSPIN ANALYSIS OF EXCHANGE MECHANISMS AND (YK)-SYSTEMS IN NN → (YK)N AT 6 GeV/c. Charlesworth, J. A.; Integar, N.; Neale, W. W.; Rushbrooke, J. G. (Cavendish Lab., Cambridge, Eng.). 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

Cross sections, isospin amplitudes, various distributions, and N^* production in the reactions NN → (ΣN)N and NN → (ΛN)N at 6 GeV/c are discussed in an isospin analysis of exchange mechanisms. (JFP)

15242 (NR-1421/VI/PH, pp 165-174) SINGLE-PARTICLE DISTRIBUTIONS AND THE THERMODYNAMIC MODEL. Ranft, G.; Ranft, J. (Karl-Marx-Univ., Leipzig). 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

Some previous results on the reactions pp → $\pi^+(\pi^-)$ + ..., Kp → K^0 + ..., $\pi p \to \pi^+(\pi^-)$ + ..., and pp → γ + ... are discussed. The velocity distribution, deviations from scaling in the central region, and the relation between the thermodynamics and the nova models are considered. (JFP)

15243 (NR-1421/VI/PH, pp 229-233) ESTIMATE OF REGGE CUTS FROM INCLUSIVE DATA. Roy, D. P.; Roberts, R. G. (Rutherford Lab., Chilton, Eng.). 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

Some interesting applications one can do with finite energy sum rules for Reggeon–particle scattering in inclusive reactions. Data for inclusive K^+p and K^-p interactions were examined to estimate the $\rho\rho$ Regge cuts in elastic pp scattering. (JFP)

15244 (NR-1421/VI/PH, pp 497-499) PART II. Test of Helicity Conservation for the $K^-\pi^+\pi^-$ System Diffractively Produced in K^-p Interactions at 14.3 GeV/c. Ljung, S. 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

Some results on double diffraction dissociation in the reaction pp → pp$\pi^+\pi^-\pi^0$ at 19 GeV/c are presented. Cross section ratios were compared for the study of factorization. It is found that the reaction mechanisms in the studied reaction differ from the mechanisms in pp → ppπ^0 reaction. (JFP)

15245 (NR-1421/VI/PH, pp 530-539) MOMENTUM TRANSFER DEPENDENCE IN DIFFRACTION DISSOCIATION. Miettinen, H. I.; Pirilae, P. 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

The origin of the strong rise of the production slope near the two-particle threshold experimentally observed in the diffractive production of two-particle system. Theoretical evidence is presented that the kinematic coupling between momentum transfers present in double-peripheral models is far too weak to explain this effect. The analysis of the 19-GeV/c data of the process pp → pnπ^+ using this method shows that the high production slope of the low mass n–π^+ system observed in this process is not a consequence of double-peripheral dynamics plus kinematics, but must be of different (unknown) dynamical origin. (JFP)

15246 (NR-1421/VI/PH, pp 540-549) DOUBLE POMERON EXCHANGE IN HIGH ENERGY PRODUCTION PROCESSES. Humble, S. 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

It is pointed out that the energy dependence of the LPS distributions is only one test of the multi Pomeron hypothesis, and a careful study of the corresponding $\pi\pi$ mass distributions can also provide information of the Regge parameters. The differential cross sections for the process pp → p$\pi^+\pi^-$p are considered. It is suggested that there is no evidence for any large double Pomeron contribution even at these higher energies. (JFP)

15247 (NR-1421/VI/PH, pp 582-602) RECENT RESULTS IN UNCORRELATED JET MODELS. Ruijgrok, T. W. (Univ. of Utrecht). 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

The review of results in uncorrelated jet models covers mathematical methods and single-particle distributions and correlations in inclusive reactions. (JFP)

15248 TEST OF POLE EXTRAPOLATION PROCEDURES IN $pp \rightarrow \Delta^{++} N$ AT 6 GeV/c. Mountz, J. D. East Lansing, MI; Michigan State Univ. (1974). 234p. University Microfilms Order No. 74-27,459.

Thesis (Ph. D.).

The experimental apparatus is designed to detect one pion production at a beam momentum of 6 GeV/c resulting from proton–proton collisions. Eighty percent of the events have the $pN\pi^+$ final state. Thirty percent of the events have the well known $\Delta^{++}_{1236}(3,3)$ resonance-neutron final state. This resonance occurs at a low $M(P\pi^+)$ and momentum transfer square. Assuming a one-pion exchange model, this resonance is produced in this reaction with a virtual pion in the initial state and a on-shell pion in the final state. The same resonance occurs in π^+p elastic scattering where the pion is on its mass shell before and after the resonance is found. The goal of this experiment is to test the accuracy of different models and extrapolation polynomials which can be used to obtain the on-shell cross section from the off-shell scattering data. It is sufficient to use form factor models if one wishes to extrapolate the total cross section. The models considered are the Chew-Low model, the Dürr Pilkuhn model, and the Benecke Dürr model. It is useful to test the validity of the extrapolation process in this case because the on-shell data is known to high accuracy. If the method proves successful, it will add credibility to cross sections obtained by extrapolating initial virtual states to the unphysical on-shell value where the on-shell data is not available, such as π-π and π-K scattering. This experiment provides 14 thousand Δ^{++} events in their raw form. The processing and corrections necessary to obtain an unbiased high quality Δ^{++} sample necessary for the extrapolation is extensively described. Due to the large number of events and the good quality of corrections, the most exacting test to date of the extrapolation technique for the cross section is given. The results indicate that the Benecke Dürr model and the Dürr Pilkuhn model are indistinguishable for the mass and t range considered. The results also show that an $At + Bt^2$ polynomial fit to the "$t\sigma$" values calculated using either of the above mentioned models will reproduce the on-shell value if the curve is extrapolated to the pole. The good fit requires no scale factors. If the same fit technique is done without requiring the curve to pass through the origin, the extrapolated cross section at $t = 0$ is consistent with zero within the limits of the error. (Diss. Abstr. Int., B)

15249 BEHAVIOR OF THE PROTON–PROTON TOTAL CROSS SECTION AT ISR ENERGIES IN THE REGGEON CALCULUS. Capella, A. (Paris-11 Univ., 91 - Orsay (France). Lab. de Physique Theorique et Particules Elementaires); Kaplan, J. (Paris-6 Univ., 75 (France). Lab. de Physique Theorique et Hautes Energies). Phys. Lett., B; 52: No. 4, 448-452(28 Oct 1974).

The behavior of σ_T^{PP} at ISR energies is studied in the Reggeon calculus with a bare triple Pomeron coupling nonvanishing at $q^2 = 0$. The parameters are determined from elastic and inclusive data. A sizable increase of α_T with s can only be obtained when the bare Pomeron intercept is such that the renormalized Pomeron singularity is above one, in the forward direction. (auth)

15250 MULTIPLICITY DEPENDENCE OF PARTICLE SPECTRA. A Peripheral Phase-Space Description with Application to 19 GeV/c pp Reactions. Frodesen, A. G. (Oslo Univ. (Norway). Fysisk Institutt); Nyborg, P. (Department of Mathematics, Agricultural University of Norway, Norway). Nucl. Phys., B; 81: No. 2, 283-300(4 Nov 1974).

As an attempt to describe the overall features of spectra of particles produced in hadronic interactions at high energy, a peripheral phase-space model is proposed which incorporates restricted transverse momenta to the outgoing particles as well as a leading particle effect. Simulating proton–proton interactions at 19 GeV/c beam momentum, the effect of modifying Monte-Carlo generated events by a matrix element containing a factor $\exp(-bp_\perp^2)$ for each outgoing particle and an exponential damping $\exp(at)$ in the momentum transfer to each of the final baryons is examined. With a fixed set of cut-off constants, a survey of spectral shapes obtained for particles of different types, pions, kaons, nucleons and hyperons, is given. In particular, the generated longitudinal spectra are shown to have a distinct dependence on multiplicity. A comparison is carried out with existing data on 19 GeV/c pp interactions obtained by the Scandinavian Bubble Chamber Collaboration. (auth)

15251 ANTIBARYON PRODUCTION AND HIGH-ENERGY OSCILLATIONS. Koplik, J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Nucl. Phys., B; 82: No. 1, 93-129 (18 Nov 1974).

Multiperipheral models are used to investigate the proposal that the experimentally observed production of antibaryons can account for most or all of the rise in the pp total cross section at ISR energies. The models support the proposal, and furthermore predict that this rise is the first part of a long-wavelength damped oscillation as a function of energy. It is found that a variety of models accommodate the antibaryon effect, and it is shown that these all lead to total cross sections consistent with present data and displaying an oscillation at higher energies. An attempt is made to understand the antibaryon cross section itself within the special case of the ABFST model, and the observed energy threshold is found to emerge naturally, but the predicted magnitude is somewhat small. The oscillations are simply parametrized in terms of complex Regge poles, and one of the models studied suggests that the leading complex pole be identified with the P'. (auth)

15252 INTERMEDIATE-RANGE NUCLEON–NUCLEON POTENTIAL. Epstein, G. N.; McKellar, B. H. J. (Univ. of Melbourne, Parkville, Australia). Phys. Rev., D; 10: No. 3, 1005-1023(1 Aug 1974).

Results of a calculation of the two-pion-exchange contribution to the nucleon–nucleon potential are presented, which when supplemented by potentials from exchange of the three-pion boson resonances should be expected to give the intermediate-range nucleon–nucleon interaction (say, in the vicinity of 1 fm). The calculated potentials are in fair agreement with the phenomenological potentials. The calculation differs from previous calculations in that the $N\bar{N} \rightarrow \pi\pi$ amplitudes used as input are in agreement with the most recent data on πN scattering and $\pi\pi$ phase shifts. A surprising feature of the results is the sensitivity of the resulting potential to permissible changes in those amplitudes dominated by the ρ meson—an uncertainty in the potential which has heretofore been overlooked. It is also found that the potential is not as energy-independent as previous calculations suggest. (auth)

15253 EXTENDED IMPULSE APPROXIMATION AND ITS APPLICATION TO THE QUASI FREE KNOCKOUT REACTIONS $^2H(p,2p)n$, $^2H(\alpha,\alpha p)n$, $^3He(p,2p)^2H$, AND $^4He(p,2p)^3H$. Mandal, K. P. Washington, DC; Georgetown Univ. (1974). 165p. University Microfilms Order No. 74-26,432.

Thesis (Ph. D.).

In many scattering processes the plane wave impulse approximation (PWIA) of Chew et al., is found to give cross sections that are too large at low incident energies. The discrepancy between the measured peak differential cross section and PWIA was reported previously. A number of modifications of the PWIA were reported. These include the distorted wave impulse approximation (DWIA), numerical evaluation of the three-body Faddeev equations and the introduction of a numerical cutoff into the internal wave function of the deuteron. None of these has been totally successful. The more exact methods give good results for lighter nuclei, but become too complicated when applied to more complex systems. The more approximate methods, on the other hand, are applicable to a range of nuclei but are not sufficiently precise for those nuclei where data are very accurately known. The impulse approximation was reformulated and extended by expanding the S-operator for the interaction in terms of the collision time τ and keeping terms up to second order in the ratio of τ/τ_B where τ_B is a time characteristic of the bound target particle. In this scheme the PWIA is considered as a lowest order approximation valid when $\tau/\tau_B \simeq 0$. The inclusion of a second order term becomes increasingly important as the incident energy decreases. It allows the binding potential to be more effective in detaining the knocked out particle which results in a reduction in the flux in the quasifree channel. The result of our EIA calculation almost completely removes the discrepancy between the observed and PWIA peak cross sections for both (p + d) and (α + d) reactions. The results for ^{3}He and ^{4}He represent a vast improvement over PWIA and the lack of complete agreement may be attributed to insufficient knowledge of the wave functions and the corresponding binding potential for these targets. (Diss. Abstr. Int., B)

15254 NOTE ON THE RISE OF HADRONIC MULTIPLICITY AT LARGE MOMENTUM TRANSFERS. Rai Choudhury, S. (Purdue Univ., West Lafayette, IN). Lett. Nuovo Cim.; 11: No. 11, 530-532(16 Nov 1974).

The possibility is pointed out of a simpler explanation which qualitatively accounts for the rise in multiplicity at around the same transverse momentum value (1 GeV) previously studied for

a forward proton in pp scattering. The variation of the average value of the cluster mass with transverse momentum is shown. (JFP)

15255 GENERALIZED EFFECTIVE-RANGE THEORY VIA OPTIMIZED EXPANSIONS WITH APPLICATIONS TO N–N SCATTERING. Choudhary, A. R. (Univ., Louvain, Belg.). Nuovo Cim.; 24A: No. 2, 161-182(16 Nov 1974).

A suitable representation for the Jost function (or the D-function in an N/D ansatz) of a partial-wave scattering amplitude, satisfying elastic unitarity and single-particle exchange dominance, is obtained from the underlying analyticity. Applications are made to the S-wave Yukawa-potential scattering and to the low energy (~200 MeV) nucleon-nucleon scattering in the S-wave. It is concluded, in keeping with the general expectations, that the formalism has a remarkable convergence and is very suitable for analytic continuations. (auth)

15256 ON THE METHOD OF THE THIN INNER TARGET IN THE STUDY OF THE ELASTIC pp- AND pd- SCATTERING. Khristov, L.; Zlatanov, Z. God. Vissh. Tekh. Ucheb. Zaved., Fiz.; 8: No. 1, 117-121(1973). (In Bulgarian).

It was shown that by change of the scattering mean free path of recoil particles in detector–photoemulsion chambers, it is possible to determine the position of the target in the direction of the primary beam with respect to the detectors with a precision of about ±1 mm and to determine the energy of the primary protons with a precision of about ±0.3 GeV in a given energy interval. (tr-auth)

15257 ABOUT THE LEPTON PAIR PRODUCTION IN HADRONIC COLLISIONS. Renard, F. M. (Montpellier-2 Univ., 34 (France). Dept. de Physique Mathematique). Phys. Lett., B; 53: No. 1, 70-72(11 Nov 1974).

Recent experiments have revealed a rather important production of leptons ($l^{\pm} = e^{\pm}$ or $\mu^{\pm}$) with large transverse momenta in high-energy proton–proton collisions. The P_T distribution of $Ed\sigma/d_3p$ at fixed angle looks very similar to the pion one, with a ratio r of the order of 10^{-4}. This is much larger than what was expected in the parton model (with parton–antiparton annihilation into lepton pairs). One could perhaps interpret these results with an ad hoc production of charmed particles (decaying into $l^{\pm}$ +X); however, first a conventional explanation within the vector dominance model is considered. (NL)

15258 SHORT RANGE CORRELATION OF IDENTICAL PARTICLES AND POMERON EXCHANGE WITH BOSE–EINSTEIN STATISTICS. Biyajima, M.; Miyamura, O. (Osaka Univ., Toyonaka (Japan). Faculty of Engineering Science). Phys. Lett., B; 53: No. 2, 181-184(25 Nov 1974).

Without introducing the cluster model and/or the concept of the broken exchange degeneracy, it is shown that the correlation function $R(y_1,y_2)$ observed at FNAL can be described by means of the Mueller–Regge model, including only Pomeron, with Bose–Einstein statistics. Transverse momentum-dependence of $R(\kappa_{1t}^2,\kappa_{1t}^2)$ reported at Serpukhov is also reproduced in this approach. (auth)

15259 HIGH ENERGY HADRON COLLISIONS AND HADRON STRUCTURE. Kuroda, M. (Tokyo Univ.). pp 391-399 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

Assuming that a hadron is made of a few numbers of constituent particles which are called quarks, the hadron–hadron scattering is described in terms of the scattering of these quarks. The geometrical impact parameter representation and the Glauber approximation are used to describe the collisions of composite particles. Total cross sections and scattering amplitudes for pp scattering and the differential cross sections for πp and $\pi\pi$ interactions are predicted. (JFP)

15260 COMMENT: MULTIPARTICLE PRODUCTIONS AND URBARYON LINES. Sasaki, T. (Tokyo Univ.). pp 423 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

On the basis of quantum field theory, the rapidity distribution of the reactions $pp \rightarrow c_i \times (c_i = \pi^+, \pi^0, \pi^-, K^+, K^0, \bar{K}^0, K^-, p, n, \bar{n}, \bar{p}, Y, \bar{Y})$ simultaneously by assuming a simplified multiperipheral model. (JFP)

Particle Invariance Principles and Symmetries

General

15261 LOW ENERGY EIGENVALUE CONDITIONS FROM DYNAMICALLY BROKEN GAUGE SYMMETRY. Englert, F.; Frere, J. M.; Nicoletopoulos, P. (Brussels Univ. (Belgium). Faculte des Sciences). Phys. Lett., B; 52: No. 4, 433-436 (28 Oct 1974).

Dynamical symmetry breakdown of a gauge-invariant Lagrangian may fix physical coupling constants via a condition unrelated to the Gell-Mann–Low equation. This condition arises when the Lagrangian couples each separate gauge field to massless fermions of definite chirality. (auth)

15262 THE GOLDSTONE THEOREM AND DYNAMICAL REARRANGEMENT OF SYMMETRY IN THE PATH-INTEGRAL FORMALISM. Matsumoto, H.; Papastamatiou, N. J.; Umezawa, H. (Wisconsin Univ., Milwaukee (USA)). Nucl. Phys., B; 82: No. 1, 45-68(18 Nov 1974).

The spontaneous breakdown of symmetry is investigated in the path-integral formalism. The generating functional is modified by the addition of a limiting "ϵ term" which fixes the direction of the breaking. The method is illustrated by means of several models with Abelian symmetries. The Goldstone theorem is a result of Ward-Takahashi identities in which the ϵ term plays a decisive role. The problem of how the original symmetry transformation of the Heisenberg fields manifests itself at the level of observable (physical) particles, expressed in terms of the infield operators $\phi^{in}(x)$, is investigated. It is proved that, if spontaneous breakdown is present, the in-field transformation $\phi^{in}(x) \rightarrow \phi^{in}(x) + \alpha(x)$, with $\alpha(x)$ satisfying the same field equation as $\phi^{in}(x)$ (Boston transformation), is an invariant transformation (i.e. leaves the equation of motion of the Heisenberg fields unchanged). It is also found that, when spontaneous breaking occurs, the invariant transformations of the Heisenberg and in-fields are different (dynamical rearrangement of symmetry). The form of the invariant in-field transformation is established for several models. (auth)

15263 ASYMPTOTIC SU(3) AND LEVEL REALIZATION OF SU(3) IN CHIRAL SU(3) ⊗ SU(3) CHARGE ALGEBRA. Oneda, S. (Univ. of Maryland, College Park). pp 538-558 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

In the framework of chiral SU(3) ⊗ SU(3) charge algebra, PCAC and asymptotic SU(3), SU(3) in particle reactions involving pseudoscalar mesons is discussed. It is shown that the effect of SU(3) breaking could appear in these reactions as an effective angular momentum barrier with $l_{eff} = 1$ and remove the vast discrepancy sometimes found between the experiment and the prediction of exact SU(3) symmetry. In order to avoid introducing the concept of exact higher symmetry from the outset, the hypothesis of asymptotic level realization of SU(3) in the algebra $[A_i,A_j] = if_{ijk}V_k$ is proposed. It is shown that, together with the "exotic" commutation relations involving the time derivative of the SU(3) charge V_K which are valid in the usual model of symmetry breaking, the hypothesis produces, among others, good result of SU(6), Schwinger's nonet mass formulas and a prediction on the general SU(3) particle mixing among mesons. (auth)

Applications (Electromagnetic and Weak)

Refer also to abstract 15604.

15264 (DESY-74/48) COMPONENTS OF νW_2 AND $SU(6)_W$ BREAKING IN DEEP INELASTIC SCATTERING. Flume-Gorczyca, B.; Kitakado, S. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Oct 1974. 26p. Dep. NTIS (US Sales Only) $4.50.

Two independent components of the nondiffractive part of the structure functions are isolated, using the data from deep inelastic eN scattering and some preliminary results from neutrino experiments. This enables one to resolve the problem of the apparent nonscaling of the Δ-resonance in the Bloom-Gilman sense and to estimate D/F for the Reggeon coupling to baryons in hadronic reactions. (auth)

Applications (Strong)

15265 HADRON–PION TRANSITION IN ASYMPTOTIC SU(3) SYMMETRY AND CHIRAL SU(3) ⊗ SU(3) ALGEBRA. Huang, C. Y. College Park, MD; Univ. of Maryland (1974). 75p. University Microfilms Order No. 74-29,072.

Thesis (Ph. D.).

Some general results of broken SU(3) symmetry for hadron-pion couplings are derived by using the chiral SU(3) ⊗ SU(3) charge algebra, the hypothesis of asymptotic SU(3), and the partially conserved axial-vector current (PCAC). The results indicate a simple characteristic of SU(3) breaking for F-type coupling. The D couplings receive a larger effect of SU(3) breaking, since the I = Y = 0 singlet-octet mixing will enter into the sum rules. In the cases which do not involve mixing, the SU(3) breaking effect can be expressed as an appearance of an effective angular momentum barrier characterized by $l_{eff} = 1$. Four specific conversion factors are derived for the baryon-meson transition, $B' \to B + \pi$, where B' is a baryon with arbitrary spin and parity while B is chosen to have either spin $\frac{1}{2}$ or $\frac{3}{2}$. When B is decimet, the effects of SU(3) breaking again appear as if the effective angular momentum barrier takes the value $l_{eff} = 1$. The saturation of the chiral SU(2) ⊗ SU(2) algebra and its implications are studied. It is shown that, if the ρ-meson is the only I = 1 vector meson; (i) the G-H saturation is justified for the case of helicity $\lambda = 0$, (ii) the whole set of sum rules is entirely consistent with each other including the second spectral function sum rules, and (iii) $m_\lambda^2 \simeq 2m_0^2$ thus follows to the extent that the KSFR relation is experimentally satisfied. The consequence of the fact that the G-H saturation assumption seems to be reasonably well justified in this particular case is further explored. It also yields that the $B \to \omega\pi$ decay takes place dominantly through the helicity states $\lambda = \pm 1$. This is consistent with present experiment. Finally the decay rates of $K_B \to K^*\pi$ and $A_1 \to \rho\pi$ are calculated. (Diss. Abstr. Int., B)

15266 SOME EXPERIMENTAL CONSEQUENCES OF SU_3 NONINVARIANCE OF THE VACUUM. Ebrahim, A. (Middle East Technical Univ., Ankara (Turkey)). Phys. Lett., B; 53: No. 1, 93-95(11 Nov 1974).

A nonlinear Lagrangian model of broken chiral $SU_3 \times SU_3$ symmetry is used to study the effect of SU_3 noninvariance of the vacuum (i.e. $f_\pi \neq f_K \neq f_\eta$) on several of the predictions of chiral $SU_3 \times SU_3$ symmetry breaking. It is found that the effect consistently alters the predictions toward better agreement with experiment. (auth)

Scattering Theory

15267 (IFVE-STF-73-81) BEHAVIOR OF THE FEYNMAN AMPLITUDES AT LARGE MOMENTA. Slavnov, D. A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 16p. (In Russian). INIS.

The asymptotic behavior of Feynman amplitudes at large momenta was studied. Not only the chief terms of the asymptotics, but also the consequences were examined. It was shown that they all have power and logarithmic character. (tr-auth)

15268 (NR-1421/VI/PH, pp 236-253) PROBLEMS OF DIFFRACTIVE SCATTERING. Low, F. (Massachusetts Inst. of Tech., Cambridge). 1972.

From 3rd international conference on many-body reactions; Zakopane, Poland (20 Jun 1972).

Theoretical models of diffraction scattering are discussed using the concept of analyticity. (JFP)

15269 REGGEIZED ABSORPTION IN THE PRESENCE OF A GREY DISC POMERON OF BALL AND ZACHARIASEN TYPE. Fujisaki, H. (Rikkyo Univ., Tokyo). Progr. Theor. Phys. (Kyoto); 51: No. 5, 1503-1512(May 1974).

Theoretical consequences of absorptive correction to the Reggeonic amplitude are studied under the assumption of a grey disc Pomeron of Ball and Zachariasen type. By the use of the procedure of the double-partial-wave amplitude recently proposed by Bronzan and Sugar, three typical conclusions are obtained with regard to the structure of l-plane singularities associated with Reggeized absorption. First, the Reggeonic amplitude with absorption has three different types of moving branch cuts in the l-plane, i.e., a logarithmic branch cut, two pairs of colliding branch cuts of logarithmic type and a pair of colliding branch cuts of square-root type. Secondly, the input Regge pole of linear trajectory-function remains unmodified on the physical sheet of l-plane. Thirdly, there is an energy-independent domain, $|t| <$ constant, of momentum transfers in which the asymptotic behavior of the full Reggeonic amplitude is controlled by the input Regge pole. These conclusions bring out in striking contrast the difference between grey and black disc Pomerons. (auth)

15270 A SCALING LAW FOR S-CHANNEL PARTIAL WAVE AMPLITUDES FROM t-CHANNEL UNITARITY. Haan, O.; Muetter, K. H. (Heidelberg Univ. (F. R. Germany). Inst. fuer Theoretische Physik). Phys. Lett., B; 52: No. 472-476(28 Oct 1974).

A solution is given for the following problem: What are the properties of s-channel partial-wave amplitudes in order to produce t-channel unitarity at threshold $t = 4\mu^2$? It turns out that the absorptive parts of the s-channel partial-wave amplitudes Im $f_l(s)$ have to obey the following scaling law: Im $f_l(s) = \sqrt{2\pi}\exp(-4sx/\mu^2)\ (\mu^6/s^3)\beta(x)/\sqrt{x}$ for $s \to \infty$, where $x = l(\mu/\sqrt{s})^2$ = fixed. The structure function $\beta(x)$ is simply related to important physical quantities: i) The behavior at $x \to 0$ is determined by the leading Regge singularity (Pomeron) $J = \alpha(t = 4\mu^2)$. ii) The asymptotic behavior $x \to \infty$ is completely determined by the s-wave scattering length. iii) The moments $\int_0^\infty dx\, x^{J+\frac{1}{2}}\beta(x)$ are determined by the scattering length of all the higher partial waves $J = 2,3,\ldots$. (auth)

15271 SCATTERING IN A QUANTUM FIELD THEORETICAL MODEL IN TWO SPACE-TIME DIMENSIONS. Dosch, H. G. (Heidelberg Univ. (F. R. Germany). Inst. fuer Theoretische Physik); Mueller, V. F. (Trier-Kaiserslautern Univ., Kaiserslautern (F. R. Germany). Fachbereich Physik). Phys. Lett., B; 52: No. 4, 445-447(28 Oct 1974).

Some properties of the S-matrix of a field theoretical model for interacting fermions in two space–time dimensions are exhibited. Although not Lorentz-invariant, this model incorporates the complications of a relativistic quantum field theory due to its particle–antiparticle symmetry. It is shown that composite bosons appearing in quantum field theoretical models of this type (studied by Mattis and Lieb) cannot be produced by collisions of physical fermions or antifermions. (NL)

15272 CAN DISPERSION INTEGRALS BE REPLACED BY DIFFERENTIAL OPERATORS? Eichmann, G. K.; Dronkers, J. (Karlsruhe Univ. (TH) (F. R. Germany). Inst. fuer Theoretische Kernphysik). Phys. Lett., B; 52: No. 4, 428-432(28 Oct 1974).

It is shown that local information on the imaginary part of the scattering amplitude is not sufficient for the exact evaluation of the dispersion integral. Qualitative results can be obtained in some cases depending on nonlocal features of the imaginary part. (auth)

15273 CONVERGENT EXPANSIONS OF TWO-BODY SCATTERING AMPLITUDES AS FUNCTIONS OF TWO COMPLEX VARIABLES. Presnajder, P.; Pisut, J. (Komenskeho Univerzita, Bratislava (Czechoslovakia)). Nucl. Phys., B; 82: No. 2, 313-322(25 Nov 1974).

The expansions of scattering amplitudes as functions of two complex variables are proposed. The expansions converge in the whole analyticity region is prescribed by the Mandelstam representation. The method may be useful for the reconstruction of scattering amplitudes from the data. A possible connection to the Atkinson approach for the construction of scattering amplitudes satisfying first principles is briefly discussed. (auth)

15274 ON THE KOHN VARIATIONAL PRINCIPLES FOR THREE-PARTICLE SYSTEMS. Merkuriev, S. P. (Leningradskij Gosudarstvennyj Univ. (USSR)). Nucl. Phys., A; 233: No. 2, 395-408(18 Nov 1974).

The Kohn-type variational principles are formulated, which can be used for calculating the (2 → 3), (3 → 2), and (3 → 3) scattering amplitudes if the two-particle wave functions are known. (auth)

15275 SATURATION OF UNITARITY BOUNDS IN PLANAR AND NON-PLANAR MODELS OF MULTIPARTICLE RESCATTERING. Schwimmer, A.; Veneziano, G. (Weizmann Inst. of Science, Rehovoth (Israel)). Nucl. Phys., B; 81: No. 3, 445-457(11 Nov 1974).

A comparative study of planar and non-planar checker-board graphs indicates that unitarity bounds can only be saturated in a non-trivial way in the second class of models. An attempt is made to rephrase these planar models in an absorption-type language, through the introduction of an "effective number of channels". (auth)

15276 ANALYTICITY PROPERTIES OF SCATTERING AMPLITUDES IN RELATIVISTIC QUANTUM THEORY. Intro-

duction to S-Matrix Theory. Iagolnitzer, D. Paris; Association pour la Diffusion de Textes Scientifiques et Litteraires (1974). 230p. $7.00.

The topics discussed are the S-matrix general properties, macroscopic causality and physical region analyticity properties of the S-matrix, discontinuity formulas, space–time description S-matrix theory, and general analyticity properties of the S-matrix outside the physical region. (JFP)

PHYSICS (LOW-TEMPERATURE)

Superfluidity

15277 SUPERCOOLING AND SUPERHEATING OF THE AB TRANSITION IN SUPERFLUID ^{3}He NEAR THE POLYCRITICAL POINT. Kleinberg, R. L.; Paulson, D. N.; Webb, R. A.; Wheatley, J. C. (Univ. of California, San Diego). J. Low Temp. Phys.; 17: No. 5-6, 521-528(Dec 1974).

Experimental measurements of the cooling (A → B) and warming (B → A) transitions between ^{3}He–A and ^{3}He–B are presented for fields of 378 and 5 G. The relationship of these measurements to the existence in zero field of a polycritical point on the line of second-order transitions is then discussed. (auth)

15278 COUPLED PHONON SPECTRUM IN ^{3}He–^{4}He SOLUTIONS. Bartley, D. L. (Univ. of Michigan, Ann Arbor); Wong, V. K.; Robinson, J. E. J. Low Temp. Phys.; 17: No. 5-6, 551-573(Dec 1974).

A simple extension of a model previously used for ^{3}He–^{4}He solutions is presented, in which the effective vertex functions between ^{3}He and ^{4}He density fluctuations are assumed to depend only on the momentum transfer. The possible zero-concentration ^{3}He quasiparticle spectra are divided into two classes, those that do and those that do not intersect the ^{4}He phonon spectrum. The present model calculations of the coupled phonon spectrum demonstrate that as the temperature is decreased the behavior of the shifts in the phonon spectrum can be considered as a signature of the class of ^{3}He quasiparticle spectrum used. Comparison with recent scattering experiments, however, indicates that the existing data are not sufficient to distinguish unambiguously between the two classes of ^{3}He spectrum. It is suggested that a low-temperature neutron scattering experiment be performed to settle this question. (auth)

15279 KAPITZA RESISTANCE TO A VARIETY OF METALLIC SURFACES BELOW 0.3 K. Folinsbee, J. T.; Anderson, A. C. (Univ. of Illinois, Urbana). J. Low Temp. Phys.; 17: No. 5-6, 409-424(Dec 1974).

The Kapitza resistance has been measured between liquid or solid ^{3}He or ^{4}He and surfaces of Mg, Cu, W, and Au in the temperature range 0.03 to 0.3 K. The experimental data are in relatively good agreement with the acoustic mismatch theory modified so as to include phonon attenuation in the metal. Below ~0.1 K the Kapitza resistance of liquid ^{3}He is often reduced relative to that of liquid ^{4}He, suggesting the presence of an enhanced thermal conduction between liquid ^{3}He and metals as has been observed in other laboratories. (auth)

15280 SUPERFLUIDITY OF SOLID ^{4}He. Fernandez, J. F.; Puma, M. (Instituto Venezolano de Investigaciones Cientificas, Caracas). J. Low Temp. Phys.; 17: No. 1-2, 131-141(Oct 1974).

Using a procedure suggested by Leggett, an upper bound to the superfluid fraction in ground state solid ^{4}He slightly above the melting density is obtained numerically. The value obtained is 0.3 ± 0.1. To judge the usefulness of this upper bound, the conditions are examined under which a symmetrized product of single-particle functions times a Jastrow function exhibits ODLRO, a necessary and sufficient condition for superfluid flow. It is found that if U_{ij} ($U_{ij} = \int \phi_i(x)\phi_j(x)dx$, and $\phi_i(x)$ is a single-particle wave function centered on the point i) satisfies $\Sigma'_j U_{ij} > x$, where x varies from unity for long range U_{ij} (i.e., U_{ij} decreases slowly enough as $R_i - R_j$ increases) to a value of 12/7 for nearest-neighbor overlap only in the hcp lattice, then there is ODLRO, but not otherwise. Therefore, if the accepted single-particle functions are the true ones, then there is no ODLRO in solid ^{4}He, since the overlap is too small. The possibility was explored of adding a flat tail, of magnitude $\lambda'(VN)^{-\frac{1}{3}}$ to the accepted single-particle functions. It is shown that if $\lambda \gg 1$ [$\lambda^2 = (\lambda')^2 + 2(\nu N V^{-1})^{\frac{1}{3}}$, and $\nu = (\int \phi_i(x)\,dx)^2$], the system wave function becomes a pure Jastrow function, whereas if $\lambda^2 - 1 \lesssim -2 \times 10^{-1}$, it is in effect the case where $\lambda' = 0$; furthermore, there is ODLRO if $\lambda^2 - 1 \gtrsim -2 \times 10^{-1}$. It is also concluded that the superfluid fraction upper bound of 0.3 ± 0.1 obtained here as well as one suggested by Leggett are not very useful. There was no attempt to establish if there is some value of λ satisfying the above inequality such that the ground-state energy is lower than the value it takes for $\lambda' = 0$. (auth)

15281 KAPITZA RESISTANCE: A UNIVERSAL CURVE. Harrison, J. P. (Queen's Univ., Kingston, Ont.). J. Low Temp. Phys.; 17: No. 1-2, 43-48(Oct 1974).

It is shown that when all unquestionable data on Kapitza resistance are plotted as reduced thermal boundary resistivity versus $T\theta_D$, then a universal curve results. The curve shows that for small $T\theta_D$, measurements are close to the acoustic mismatch theory, and for large $T\theta_D$ they are close to the phonon radiation limit. The parameter $T\theta_D$ extends over three orders of magnitude, which compares with the usual factor of two in most measurements. The universality has several implications: First, it shows that Kapitza resistance is to first approximation a bulk effect; next, the curve can be used to test theories of Kapitza resistance (an example is given); finally, the value for an unmeasured solid–liquid helium interface can be estimated with some reasonable confidence. (auth)

15282 DISPERSION OF ZERO SOUND IN LIQUID ^{4}He. Sposito, G. (California State Coll. Sonoma, Rohnert Park). J. Low Temp. Phys.; 17: No. 1-2, 1-5(Oct 1974).

A new derivation of Pines' zero-sound model of the phonon in liquid ^{4}He is presented which shows that the essential assumption in the model is that the mechanism of phonon damping in no way depends upon the mechanism for creating phonon modes. The result of a numerical calculation of the dispersion relation for zero sound in the wave number range $0 \leq k \leq 0.2$ Å^{-1} is given and is shown to be in very good agreement with recent direct measurements of the speed of superthermal phonons in He II by Narayanamurti, Andres, and Dynes. (auth)

15283 ENERGY TRANSFER FROM SOLIDS TO HELIUM VAPOR BY THE DESORPTION OF SURFACE-BOUND ATOMS. Long, A. R. (Univ. of Cambridge, Eng.). J. Low Temp. Phys.; 17: No. 1-2, 7-23(Oct 1974).

Energy transfer from solid to helium vapor by desorption of surface-bound helium atoms is examined. The ideas presented give a good qualitative explanation of recent phonon reflection data, and preliminary numerical estimates of the transition probability are in order of magnitude agreement with observation, provided the influence of surface waves is included. (auth)

Superconductivity

Refer also to abstracts 13826, 14585, 14586, 14601, 14604, 14610, 14611, 14613–14616, 14694–14696, and 14699.

15284 EFFECT OF FLUCTUATION ELECTRON PAIRS ON ABSORPTION OF SOUND IN METALS ABOVE THE SUPERCONDUCTING TRANSITION POINT. Cheishvili, O. D. (Inst. of Physics, Tbilisi, USSR). Zh. Eksp. Teor. Fiz.; 67: No. 5, 1785-1792(Nov 1974). (In Russian).

It is shown that the existence of fluctuation Cooper electron pairs in the normal state near the critical temperature appreciably affects the absorption of sound in metals. The effect if particularly pronounced in films and filamentary samples. In "contaminated" films of thickness $d \ll [\xi_0 l T_c/(T-T_c)]^{\frac{1}{3}}$ the fluctuation correction to the absorption coefficient may be of the order of the major term at temperatures $T - T_c \sim 10^{-2}$–10^{-3} K. It is shown that near the transition temperature and for large intensities of sound (attainable in the experiments) the fluctuation correction to the absorption coefficient depends on the intensity of sound. (auth)

15285 QUALITATIVE PATTERN OF THE TWO-DIMENSIONAL MIXED STATE IN SUPERCONDUCTORS OF THE FIRST KIND. Gor'kov, L. P.; Dorokhov, O. N. (Inst. of Theoretical Physics, Moscow). Zh. Eksp. Teor. Fiz.; 67: No. 5, 1925-1931(Nov 1974). (In Russian).

A structure of a thin superconducting layer arising on the surface of a hollow current-carrying cylinder is proposed which consists of alternating superconducting phase rings separated by narrow normal phase rings. Formulas are derived for the additional nondissipative current related to the structure. (auth)

15286 FREQUENCY DEPENDENCE OF SUPERCONDUCTIVITY STIMULATED BY A HIGH FREQUENCY FIELD IN FILM BRIDGES. Latyshev, Yu. I.; Nad, F. Ya. (Inst. of Radio Engineering and Electronics, Moscow). JETP Lett. (USSR) (Engl. Transl.); 19: No. 12, 380-382(20 Jun 1974).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 19: No. 12, 737-741(20 Jun 1974).

The existence of lower and upper frequency limits to the growth of the critical current of film bridges under the action of high-frequency radiation is established experimentally. (auth)

15287 WAVE RESISTANCE OF INDIUM IN THE INTERMEDIATE STATE. Krylov, I. P. (Inst. of Physics Problems, Moscow). JETP Lett. (USSR) (Engl. Transl.); 19: No. 12, 375-376(20 Jun 1974).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 19: No. 12, 726-729(20 Jun 1974).

An increase of the resistance of samples of ultrapure indium was observed in the intermediate state following application of a static inhomogeneous field near the surface of the sample. It is proposed that this effect is due to excitation of helicons in the structure of the layers of the normal and superconducting phase, in analogy with the manner in which the resistance to the motion of a ship is connected with excitation of waves on a water surface. (auth)

15288 PROPERTIES OF THE FLUX LINE LATTICE IN HYSTERETIC TYPE II SUPERCONDUCTORS. II. Neutron Depolarization Experiments. Weber, H. W. (Oesterreichischen Hochschulen, Vienna). J. Low Temp. Phys.; 17: No. 1-2, 49-63(Oct 1974).

Neutron depolarization experiments made on the same samples as investigated previously by neutron diffraction experiments (part I of this report) are presented. The correlations between crystal lattice and flux line lattice are shown to lead to a different field dependence of the average misalignment of the flux lines compared with polycrystalline materials. The average tilting angles are found to depend strongly on the magnetic field and to differ for increasing and decreasing fields in the same way as the mutual misorientations of single-crystalline flux line blocks in the plane perpendicular to the field. For a known defect structure the tilting angles may be used to calculate the average displacement of the flux lines and the basic pinning forces. (auth)

15289 DENSITY OF STATES, ENTROPY, AND SPECIFIC HEAT FOR DIRTY TYPE II SUPERCONDUCTORS AT ARBITRARY TEMPERATURE. Watts-Tobin, R.; Kramer, L.; Pesch, W. (Kernforschungsanlage, Juelich, Ger.). J. Low Temp. Phys.; 17: No. 1-2, 71-86(Oct 1974).

Using a recent dirty-limit version of the Gor'kov theory, numerically, the analytic continuation of the thermal Green's function onto the real axis is calculated. The order parameter and the magnetic field are determined self-consistently within the circular cell approximation of the vortex lattice. From the Green's functions one obtains the density of states and various thermodynamic quantities. The results are compared with experiments and an approximate theory by Takayama and Maki. (auth)

15290 CALCULATION OF THE CRITICAL CURRENT DENSITY OF HARD SUPERCONDUCTORS FROM THE MAGNETIZATION OF CYLINDRICAL SAMPLES. Lange, F. (Zentralinstitut fuer Feskoerperphysik und Werkstofforschung, Dresden). J. Low Temp. Phys.; 17: No. 1-2, 65-69(Oct 1974).

A new approximation formula for the critical current density is presented which is more exact than those proposed previously and allows the evaluation of the current density in the range of the initial magnetization curve. The relative error is calculated for one practical case and is plotted for the different branches of the magnetization curve. (auth)

15291 ELECTROMAGNETIC WAVE ATTENUATION BY SUPERCONDUCTING FLUCTUATIONS IN A THIN, GRANULAR ALUMINUM FILM. Robinson, D. A.; Salvo, H. Jr.; Maki, K.; Levy, M. (Univ. of Wisconsin, Milwaukee). J. Low Temp. Phys.; 17: No. 1-2, 121-129(Oct 1974).

A sharp local minimum has been observed at T_c in the microwave attenuation by a thin, granular aluminum film which is believed to result from the imaginary component of the fluctuation conductivity and for which the particular geometry of the specimen appears to enhance the observation of the fluctuation effects. (auth)

15292 MECHANICAL ANALOG OF THIN-FILM JOSEPHSON JUNCTION AND ITS PINNING EFFECT. Yamashita, T. (Univ., Lausanne, Switzerland); Rinderer, L.; Nakajima, K.; Onodera, Y. J. Low Temp. Phys.; 17: No. 1-2, 191-200(Oct 1974).

A simple mechanical analog of a thin-film Josephson junction was constructed and λ_J, I_0, and $H_{2\pi}$ for the mechanical analog were defined. By using the mathematical analogy, the boundary conditions were introduced to obtain the I_c-H_e characteristics of the mechanical analog. The typical Fraunhofer pattern in the I_c-H_e characteristics was observed for a small junction. For a long junction, the pinning effect of the Josephson junction was analyzed by using the analogy of a vortex in a type II superconductor and it was found that when normal material is inserted into the Josephson junction as a pinning center, the critical Josephson current increases at an appropriate applied field. The relations between the pinning effect and the superconducting quantum interference effect were discussed. (auth)

15293 INFLUENCE OF SHORT-RANGE MAGNETIC CORRELATIONS ON THE SUPERCONDUCTING TRANSITION TEMPERATURE. Entel, P.; Klose, W. (Univ., Geneva). J. Low Temp. Phys.; 17: No. 5-6, 529-538(Dec 1974).

Taking into account correlations between well-defined localized magnetic moments in a dilute magnetic system, we derive an expression for the superconducting transition temperature which is different from Bennemann's theory. In particular it is shown that the influence of short-range magnetic correlations in the vicinity of a magnetic phase transition on the superconducting transition temperature is twofold: (1) There are large corrections to the Abrikosov–Gor'kov theory. (2) For a certain choice of parameters the phase diagram in the temperature versus concentration plane shows a break (where the system is normally conducting) between two superconducting regions. (auth)

15294 POSITIVE CURVATURE IN THE DEPENDENCE OF H_{c_2} ON T IN LAYERED SEMICONDUCTORS: CONSEQUENCE OF JOSEPHSON INTERACTION BETWEEN LAYERS. Bulaevskii, L. N.; Guseinov, A. A. (Lebedev Inst. of Physics, Moscow). JETP Lett. (USSR) (Engl. Transl.); 19: No. 12, 382-383(20 Jun 1974).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 19: No. 12, 742-744(20 Jun 1974).

It is shown that the experimental data for the temperature dependence of the upper critical field of an intercalated layered superconductor $Cs_{0.3}MoS_2$ indicate that a Josephson interaction between layers is realized in this compound. (auth)

PHYSICS (NUCLEAR)

15295 (COO-2130-119, pp 1-31) HEAVY-ION SCIENCE: A BRIEF OVERVIEW. Bromley, D. A. 1973.

In heavy ion lecture series. Volume I.

A general overview of the whole field of heavy-ion physics is given. The author attempts to give some perspective, some kind of framework, and some discussion of where the field is going. Many different topics are briefly touched upon, including the following: beta stability, superheavy elements, electrodynamics, highly excited nuclei, nuclear molecules, heavy-ion reactions, nuclear structure, nuclear matter, Lamb shift studies, spectroscopy of highly stripped species, solid state phenomena, interatomic and crystalline forces, high-temperature superconductors, ion implantation, radiation damage, and biomedicine. (6 figures) (RWR)

Neutron Interactions with Matter

Refer also to abstracts 14629 and 15382.

15296 (AWRE-O-45/74) COMPUTERISED STORAGE AND RADIOCHEMICAL INTERPRETATION OF NUCLEAR DECAY SCHEMES: THE CASCADE PROGRAM. Vallis, D. G. (UKAEA Weapons Group, Aldermaston. Atomic Weapons Research Establishment). Nov 1974. 60p. Dep. NTIS (US Sales Only) $6.00. UK Pounds 1.

A nuclear decay scheme can be represented by a set of arrays whose elements are the values of nuclear transition properties. A computer program, CASCADE, was written in FORTRAN IV for the IBM 370/165 to convert these data into another set representing the intensities and composition of radiation emission sequences ("cascades") by carrying out a systematic examination of all possible decay routes through intermediate nuclear states. The derivation of cascade arrays is modified to take account of the lifetimes of intermediate states if significant compared with the resolving time of a detector. (14 figures) (auth)

15297 (BNL-tr-582) WAVE PROPERTIES OF ULTRACOLD NEUTRONS. Frank, I. M. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1974. Translation by S. J. Amoretty of JINR-P3-7809. 22p. Dep. NTIS $4.25.

The analogy between the indexes of refraction of neutron and light waves is discussed. The influence of the effective field on the neutron absorption coefficient is considered. It is shown that for the case of neutron waves the imaginary part of this field must not be neglected. Proper account of the effective field probably will enable one to reveal experimentally the anomaly found in the storage time of ultracold neutrons. (auth)

15298 (IAE-2280) GALERKIN METHOD FOR DIFFUSION EQUATIONS. Part 3. Program RZ-1. Lebedev, V. I.; Kurchenkova, G. I.; Tsapelkin, E. S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1973. 43p. (In Russian). INIS.

The RZ-1 program, which uses the Galerkin method for the calculation of two-group neutron distributions in multizone reactions in (r,z) geometry, is given. (JSR)

15299 (IAE-2352) NEUTRON TRANSPORT IN MEDIA WITH CHANGING PARAMETERS. III. Differential Properties of Evolution Operator. Novikov, V. M.; Shikhov, S. B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1974. 52p. (In Russian). INIS.

The kinetic equation of neutron transport was examined under the condition of random physically permissible changes in the parameters of the medium for any finite number of groups of delayed neutrons. The differential properties of the evolution operator in $R^{(P)}$ sets were studied. The possibility of a term-by-term differentiation of a series representing the evolution operator and the existence of a classical solution and a uniform correctness of Cauchy problems in classes of $R^{(P)}$ functions for the corresponding types of parameter changes of the media were shown. It was shown that, if the original condition is sufficiently smooth, in the evolution processes the gradient of the total neutron density can have no more than a logarithmic singularity. (5 figures) (tr-auth)

15300 (IAEA-R-1228-F) INVESTIGATION OF THE TRANSPORT EQUATION FOR NEUTRON SLOWING DOWN IN MEDIA OF CROSS SECTIONS WITH UNUSUAL ENERGY AND ANISOTROPY DEPENDENCE. Coordinated Program in Methods in Neutron Transport Theory. Final Report for the Period 1 August 1972-30 November 1973. Inonu, E. (International Atomic Energy Agency, Vienna (Austria)). Mar 1974. 68p. INIS.

15301 (IEA-306) TWO-GROUP NEUTRON-TRANSPORT THEORY WITH LINEARLY ANISOTROPIC SCATTERING. Half-Range Orthogonality and Critical Slab Problem. Ishiguro, Y. (Instituto de Energia Atomica, Sao Paulo (Brazil). Divisao de Operacao e Manutencao de Reactores). Aug 1973. 43p. INIS.

Half-range adjoint functions concerning the elementary solutions of the two-group one-dimensional neutron-transport equation for linearly anisotropic scattering are established. The half-range orthogonality relation is based on matrix functions which can be computed from regular Fredholm-type equations. All necessary integrals are evaluated and several typical problems are solved in a concise manner. The established orthogonality relation is used to reduce critical slab problems to a suitable computational form. Exact values of critical dimensions are reported for selected sets of parameters. Computations of the eigenvalues and fundamental matrices are also discussed. (auth)

15302 (IFA-DNBR-5-1973) CALCULATION OF THE THERMAL NEUTRON SCATTERING LAW, THE ELIN CODE. Rapeanu, S.; Padureanu, L; Deciu, N. (Institutul de Fizica Atomica, Bucharest (Romania)). 1973. 14p. INIS.

The scattering law, $S(\alpha,\beta)$, for both small and large momentum and energy transfers is calculated. Two models for frequency distribution functions are taken into account, in order to give the incoherent scattering of neutrons by liquids and solids. The calculations were performed in the incoherent and gaussian approximations. $S(\alpha,\beta)$ is evaluated as a function of the dimensionless variables α and β, where the (α,β) mesh is α + 0.05-5 (and β + 0.1-5). The ELIN code for computing the scattering law is used. (auth)

15303 (IFA-RT-4-1974) SEPARATING EIGENVALUES FOR THE BOLTZMANN THERMALIZATION OPERATORS IN THE CASE OF GRAPHITE BY THE PULSED NEUTRON SOURCE METHOD. Racataian, I.; Postelnicu, C.; Mociornita, G.; Marcu, G.; Maianu, E. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 12p. (In Rumanian). Dep. NTIS (US Sales Only) $4.00.

The theory of the pulsed neutron source method for the measurement of Boltzmann thermalization operators is outlined. The experimental results obtained for graphite by using this method are reported. (1 table) (JSR)

15304 (INIS-mf-1335) NEW MEASUREMENT OF THE TOTAL NEUTRON CROSS SECTION OF D_2O AT 20°C BETWEEN 0.0005 AND 10 eV. Kropff, F.; Latorre, J. R.; Granada, J. R. Castro Madero, C. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). [nd]. 5p. INIS.

Thesis.

The total neutron cross section of heavy water at 20°C was measured in the range 0.0005 to 10 eV by the transmission method with pulsed neutron time-of-flight techniques. Corrections were made for 0.4% HOD contamination. (auth)

15305 (LA-5760) MODIFIED DIFFERENCE SCHEMES FOR THE TRANSPORT EQUATION SOLUTION. Carlson, B. G. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1974. Contract W-7405-eng-36. 21p. Dep. NTIS $4.00.

An improved set of numerical methods for solving the neutron transport equation in one or several variables is presented. The revised methods, like earlier S_n-type methods, are based on the multigroup, discrete ordinates reduction of the equation and on simple difference methods with certain iterative techniques for obtaining solutions. The improved set provides reasonable remedies for most of the problems encountered in using codes based on earlier methods, such as oscillating fluxes and ray-effect distortions. (1 figure, 4 tables) (auth)

15306 CALCULATION OF THE ABSORPTION COEFFICIENT OF ULTRACOLD NEUTRONS IN A MEDIUM WITH A ROUGH SURFACE. Stepanov, A. V.; Shelagin, A. V. Kratk. Soobshch. Fiz.; No. 1, 12-19(1974). (In Russian).

A correction was obtained to the absorption coefficient of ultracold neutrons in traps because of slight roughness of the walls. The effect examined does not explain available experimental data. (tr-auth)

15307 THEORY OF RESONANCE-GROUP SELF-SHIELDING. Segev, M. (Soreq Nuclear Research Centre, Yavne, Israel). Nucl. Sci. Eng.; 56: No. 1, 72-82(Jan 1975).

Resonance self-shielding occurs as the result of flux depressions at resonance peaks. The group self-shielding factor is defined as the ratio of the effective flux-weighted cross section to the average cross section. Given a constant background cross section, σ, as well as a temperature and an energy group, the shielding factor of an element can be approximated by simple formulas employing two- or three-group effective parameters. These are λ, η, and ρ—an effective base (potential scattering) cross section, an effective peak cross section, and an effective ratio of the base cross section to the average of the resonance total cross section, respectively. The use of resonance group parameters eliminates the problem of σ interpolation. Furthermore, through a certain interpretation of these parameters, the σ ambiguity is also cleared up. The constant background, σ, required to represent the actual interaction of the shielded resonance series with background resonance series, is a linear expression in the number densities and the λ's of the background elements. The σ iteration technique, currently in use, is shown to be rather inaccurate. (1 figure, 5 tables) (auth)

Nuclear Properties and Reactions, A ≤ 5

Refer also to abstracts 14797, 15229, 15358, 15453, 15476, and 15537.

15308 (CEA-R-4632) UNCERTAINTIES IN THE DIFFERENTIAL CROSS SECTION OF $^{1}H(n,n)^{1}H$ SCATTERING BETWEEN 1 TO 20 MeV. Voignier, J. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). Nov 1974. 33p. (In French). Dep. NTIS (US Sales Only) $4.75.

In the region of incident neutron energies from 100 keV to 20 MeV, the total cross section for neutron-proton scattering is known with an accuracy of 0.5%. Total cross sections are fairly easy to measure and are therefore more reliable and accurate than differential cross sections. The angular distribution of neutrons are analyzed. Uncertainties on both the analysis and the measurements are discussed. The analysis uncertainties arise because of the different formalisms used to represent the scattering. The experimental uncertainties, which in most cases exceed 2%, are shown greater than the theoretical discrepancies (<1%). (auth)

15309 (COO-535-710, pp 50-51) SCATTERING OF 27-MeV PROTONS BY POLARIZED ^{3}He. Ware, R. H.; Smythe, W. R. 1 Nov 1974.

In technical progress report, November 1, 1973–November 1, 1974.

15310 (ITEP-75) INTEGRAL EQUATION APPROACH TO THE FOUR NUCLEON BOUND STATES. Narodetskii, I. M. (Gosuderstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSR, Moscow. Inst Teoreticheskoj i Ehksperimental'noj Fiziki). 1973. 40p. INIS.

Within the framework of Yakubovsky four body equations the O^{+} bound states of ^{4}He are determined. The two-particle interactions used are of the separable Yamaguchi form and include spin-dependent forces. The problem is reduced to the solution of four coupled integral equations in two variables. The separable approximation of the kernels makes it possible to reduce the problem to a set of single variable integral equations. The separable approximation method employed is based on Hilbert–Schmidt expansion applied to the kernels of four-body equations. The ground state energy of ^{4}He is found to be −45.73 MeV, the excited O^{+} level lies at −11.69 MeV. In conclusion an accuracy of several approximate methods in the four-nucleon problem is also discussed. (auth)

15311 (LBL-2935) FINAL STATE INTERACTION IN THREE NUCLEON SYSTEM. Rad, F. N.; Saylor, D. P.; Jain, M. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 24 Jul 1974. 5p. (CONF-740822-7). Dep. NTIS $4.00.

From conference on few body problems in nuclear and particle physics; Quebec, Canada (27 Aug 1974).

Vector to vector spin-transfer parameters for slightly inelastic p-d scattering are discussed in the context of recent theoretical and experimental developments. (auth)

15312 (LBL-2995) POLARIZATION PHENOMENA IN THE THREE-NUCLEON SYSTEM. Conzett, H. E. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Aug 1974. Contract W-7405-eng-48. 21p. (CONF-740822-6). Dep. NTIS $4.25.

From conference on few-body problems in nuclear and particle physics; Quebec, Canada (27 Aug 1974).

The discussion of polarization phenomena in the three-nucleon system covers analyzing powers in nucleon–deuteron elastic scattering, polarization transfer in nucleon–deuteron elastic scattering, and polarization effects in the N–d breakup reaction. (JFP)

15313 THREE-NUCLEON GROUND-STATE PROPERTIES DERIVED FROM THE SOFT-CORE REID POTENTIAL. Strayer, M. R.; Sauer, P. U. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Nucl. Phys., A; 231: No. 1, 1-12(7 Oct 1974).

The three-nucleon ground state properties are computed using all partial waves of the soft-core Reid potential. A linear variational calculation is carried out in a translationally invariant basis of harmonic oscillator functions having definite orbital particle permutation symmetry and having a definite orbital angular momentum. The basis includes the symmetric S and the mixed symmetry S and D states and includes up to 4654 linear variational parameters. Computations are presented for the binding energy, the rms charge radius and the electric form factor in the single impulse approximation. The resulting upper bound for the ^{3}H binding energy is −6.7 MeV. The resulting ^{3}He electric form factor has its first diffraction minimum at $q_0^2 = 12.6\ fm^{-2}$. (auth)

15314 NEUTRON-NEUTRON EFFECTIVE RANGE PARAMETERS FROM KINEMATICALLY COMPLETE EXPERIMENTS ON THE REACTION $^{2}H(n,2n)^{1}H$. Zeitnitz, B.; Maschuw, R.; Suhr, P. (Hamburg Univ. (F. R. Germany). 2. Inst. fuer Experimentalphysik); Ebenhoeh, W. (Heidelberg Univ. (F. R. Germany). Inst. fuer Theoretische Physik); Bruinsma, J.; Stuivenberg, J. H. (Vrije Universiteit, Amsterdam (Netherlands). Natuurkundig Lab.). Nucl. Phys., A; 231: No. 1, 13-28(7 Oct 1974).

In simultaneous complete experiments on the reaction $^{2}H(n,2n)^{1}H$ neutron–neutron and neutron–proton final-state interactions were observed. The experiments were analyzed with three-body calculations using different form factors for the nucleon–nucleon interactions. The analysis with a complete charge dependent calculation using exponential form factors gave $a_{nn} = -16.3 \pm 1.0$ fm for the $^{1}S_{0}$ neutron–neutron scattering length and $r_{nn} = 2.13 \pm 0.4$ fm for the effective range. (auth)

15315 NUCLEON EXCHANGE AND QUASI-FREE SCATTERING IN THE REACTION $^{1}H(d,pn)p$ AT 12.2 MeV. Okumusoglu, N. T.; Blyth, C. O.; Dunscombe, P. B.; Berovic, N.; McKee, J. S. C. (Birmingham Univ. (UK). Dept. of Physics). Nucl. Phys., A; 231: No. 3, 391-396(21 Oct 1974).

The $^{1}H(d,pn)p$ reaction has been studied in the vicinity of the kinematic region for quasi-free p–p scattering. A Treiman–Yang test, carried out at an incident deuteron energy of 12.2 MeV and for low momentum transfer to the proton target, shows that nucleon exchange is the dominant process under these conditions. (auth)

15316 DISTORTED WAVE IMPULSE APPROXIMATION CALCULATION OF pd → tπ. Fearing, H. W. (Alberta Univ., Edmonton (Canada). Nuclear Research Centre). Phys. Lett., B; 52: No. 4, 407-410(28 Oct 1974).

The deviation of an improved impulse approximation calculation of (p,π) reactions on nuclei is outlined. Distortion effects are included and, unlike previous calculations, crude approximations for the wave functions are not needed. The formalism is applied to pd → tπ and a significant improvement in fits to the data is obtained, although the backward peak at 470 MeV still cannot be reproduced. (auth)

15317 d-^{3}He INTERACTION STUDY. Lyovshin, E. B.; Nemets, O. F.; Yasnogorodsky, A. M. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). Phys. Lett., B; 52: No. 4, 392-394(28 Oct 1974).

In this work, optical-model calculations are carried out for the cross sections $d\sigma_0(\theta)/d\omega$ and all the analyzing power components $T_{kq}(\theta)$ in the elastic scattering $^{3}He(d,d)^{3}He$ in the 10–14 MeV energy range. The results are compared with experiment, and the spin dependence of the interaction is discussed. (NL)

15318 CLUSTER MODEL DESCRIPTION OF THE $d(\alpha,\alpha p)n$ BREAK-UP AS TWO-STEP REACTION. Heiss, P.; Hackenbroich, H. H.; (Koeln Univ. (F. R. Germany). Inst. fuer Theoretische Physik); Prescher, K. (Koeln Univ. (F. R. Germany). Inst. fuer Kernphysik). Phys. Lett., B; 52: No. 4, 411-413(28 Oct 1974).

The ^{6}Li scattering system has been described in the framework of the multichannel cluster model reaction theory. Under the assumption of sequential decay, cross sections for the $^{4}He - d \rightarrow {}^{5}He - p \rightarrow {}^{4}He - n - p$ process have been calculated. Comparison of the theoretical results with recent experimental data shows

good agreement for those kinematical situations in which the sequential decay mechanism dominates. (auth)

15319 POLARIZATION PHENOMENA UNDER FAST ELECTRON SCATTERING BY DEUTERONS. Malyarzh, E. M. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki); Tartakovsky, V. K. (Kievskij Gosudarstvennyj Univ. (Ukrainian SSR)). Phys. Lett., B; 53: No. 1, 18-20(11 Nov 1974).

The polarization of nucleons which arises in deuteron electrodisintegration is considered as a function of the angle between nucleon trajectories. In electron scattering by large angles the polarization is affected by the interaction in the final state as well as by the presence of a D-wave component in the deuteron ground state. It is shown that the polarization degree of the product nucleons essentially depends on the choice of radial parts of the deuteron wave-function and the D-wave contribution in the deuteron ground state. (auth)

Nuclear Properties and Reactions, 6 ≤ A ≤ 19

Refer also to abstracts 13816, 14139, 15166, 15364, 15367, 15370, 15373, 15377, 15383, 15385, 15393, 15453, 15504, 15508, 15524, 15529, 15534, and 15547.

15320 (CEA-R-4629) SECOND ORDER CORRECTIONS TO THE HARTREE-FOCK ENERGIES OF SPHERICAL NUCLEI. Maire, M. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92-Montrouge (France)). Nov 1974. 122p. (In French). Dep. NTIS (US Sales Only) $9.25.

The realistic nucleon-nucleon interaction proposed by Gogny, Pires and de Tourreil is such that it is not necessary to have recourse to Brueckner theory in treating n-body problems. Therefore, ordinary perturbation theory was used to calculate the equilibrium properties (binding energy, density, radius and separation energy) of ^{16}O, ^{40}Ca, ^{90}Zr and ^{208}Pb. The expansion is to second order, using a Hartree-Fock basis. Unoccupied states are approximated by plane waves. In the Hartree-Fock approximation, the radii obtained for the four nuclei are satisfactory. For the binding energies, the second order result is 25 to 30% of the Hartree-Fock potential energy. To second order, the binding energy is about 8 MeV per nucleon in ^{16}O, 10 MeV per nucleon in ^{208}Pb and 17 MeV per nucleon in nuclear matter. Furthermore, the second order corrections improve the Hartree-Fock single particle energy spectrum. Results are compared with some Brueckner-Hartree-Fock calculations. Generally, it has been said that two-nucleon interactions with a weak repulsive core cannot reproduce correct saturation properties of nuclear systems. This remark does not seem to apply to the interaction of Gogny et al. (auth)

15321 (COO-535-710, pp 47-49) STUDY OF UNBOUND LEVELS IN ^{16}C VIA $^{10}B(^3He,t)$. Schneider, M. J.; Ridley, B. W.; Rickey, M. E.; Kraushaar, J. J. 1 Nov 1974.

In technical progress report, November 1, 1973-November 1, 1974.

15322 (COO-2130-119, pp 32-76) SIMPLE HEAVY-ION INTERACTIONS. Bromley, D. A. 1973.

In heavy ion lecture series. Volume I.

The simplest, most readily studied heavy-ion reactions are discussed. First considered is elastic scattering, and whether this can be understood in terms of simple physical pictures. Next most complicated is inelastic scattering, and then elastic transfer. Since the de Broglie wave lengths of heavy ions are so short, to a good approximation one can forget about quantum mechanics and consider the optical phenomena of Fraunhofer and Fresnel diffraction. (43 figures) (RWR)

15323 (COO-2130-119, pp 207-233) HEAVY-ION REACTIONS: ARE THEY WORTHWHILE? Robson, D. 1973.

In heavy ion lecture series. Volume I.

The lecture begins with a brief discussion of the production of superheavy nuclei by means of heavy-ion reactions. Politics in the heavy-ion field is touched upon. The bulk of the paper gives an overview of the kinds of things which occur in experiments with heavy ions on heavy ions, complex nuclei on complex nuclei, that contain information unobtainable with other techniques. These include elastic and inelastic scattering, transfer reactions, and spallation (or production of many fragments). (11 figures) (RWR)

15324 (COO-2130-119, pp 234-258) ELASTIC AND INELASTIC SCATTERING OF HEAVY IONS. Robson, D. 1973.

In heavy ion lecture series. Volume I.

The emphasis of this lecture is on elastic scattering, beginning with the basics and including a fairly lengthy exposition on the optical model. The paper concludes with a discussion of elastic transfer. (6 figures) (RWR)

15325 (FRNC-TH-491) STUDY OF (τ,α) REACTIONS AT 217 MeV: APPLICATIONS TO $^{12}C(\tau,\alpha)^{11}C$ AND $^{16}O(\tau,\alpha)^{15}O$ REACTIONS. Van de Wiele, J. (Paris-11 Univ., 91 - Orsay (France)). 1973. 91p. (In French). Dep. NTIS (US Sales Only) $7.75.

Thesis.

Single neutron pick-up reactions ((τ, α) type) at an incident energy of 217 MeV were studied. $^{12}C(\tau, \alpha)^{11}C$ and $^{16}O(\tau, \alpha)^{15}O$ present appreciable cross sections at this energy (approximately 10mb/st and 2.3mb/sr at 6 deg (laboratory system) for the ground states of ^{11}C and ^{15}O respectively); the angular distributions obtained exhibit a very sharp decay with angle. The distributions corresponding to the following levels are given: $3/2^-$ (ground state), $1/2^-$ (2 MeV), $5/2^-$ (4.3 MeV), $3/2^-$ (4.8 MeV) and $7/2^- + 5/2^+$ (6.48 MeV + 6.91 MeV) of the $^{12}C(\tau,\alpha)^{11}C$ reaction; $1/2^-$ (ground state), $1/2^+ + 5/2^+$ (5.19 MeV + 5.24 MeV) and $3/2^-$ (6.18 MeV) of the $^{16}O(\tau,\alpha)^{15}O$ reaction. The experimental results obtained for $^{16}O(\tau,\tau)^{16}O$ elastic scattering at 217 MeV and $^{16}O(\alpha,\alpha)^{16}O$ elastic scattering at 166 MeV are presented. The experimental results are interpreted in the framework of the classical DWBA, an attempt being made to establish the intermediate energy behavior of the different factors appearing in the cross section calculation. The (τ,α) reaction mechanism at 217 MeV appears to be more complicated than that of a simple single neutron pick-up (where the neutron is in the ground state of the target). A two-stage process is postulated. Two complementary detection systems were developed to study this type of reaction: primary analyzer; secondary analyzer with a multiwire chamber and a $\Delta E(Si) \times E(Ge-Li)$ telescope. The first system enables cross sections corresponding to angles in the region of 0 degrees to be determined, while the second system permits the complete exploration of the α spectra associated with high excitation energies to be investigated together with the continuum. In this way, levels which are not close to the ground state can also be studied. (auth)

15326 (INIS-mf-1275) ANGULAR DISTRIBUTION AT THE SCATTERING OF SPIN ½ PARTICLES BY ½ SPIN NUCLEUS. Garcia G, R. (Universidad Nacional Autonoma de Mexico, Mexico City. Facultad de Ciencias). 1973. 60p. (In Spanish). INIS.

Thesis.

A general analysis was made of the process of nuclear reactions and the theoretical results were applied to the case of $^3He(p,p)^3He$, which is a typical case. By means of a computational program the mixing and phase eigenvalue parameters were adjusted to the angular distribution experiment. These parameters fit the data on the orbital and total angular momenta and the spins and parities of the system considered. (tr-auth)

15327 (INIS-mf-1428) ENERGY CORRELATIONS IN DEUTERON SCATTERING AND STRIPPING REACTIONS ON ^9Be. I. Multiparticle Reactions Induced by Deuterons on ^9Be at 26.3 Modifications and Extensions MeV. Sonnemans, M. A. A. (Amsterdam Univ. (Netherlands)). 3 Apr 1974. 51p. INIS.

Two-body and multi-body nuclear reaction processes, resulting from the interaction of 26.3 MeV deuterons with ^9Be nuclei, were studied. The experiments are performed using the measuring system "BOL" of the Institute for Nuclear Physics Research (I.K.O.) at Amsterdam, which contain 64 detection units. The details of the experiment and the data analysis procedures are described. The measured dependence of the differential reaction cross section on the detection angle and excitation energy is given for deuteron scattering and for the (d,p) stripping reaction. Comparison of the experimental elastic angular distribution with various optical model calculations yields preference for a volume absorption potential. DWBA fits of the inelastic angular distributions for the 2.43 MeV and the 6.76 MeV level support a large deformation of the ^9Be nucleus. The (d,p) angular distributions, though, are less well described by the DWBA theory with a delta function interaction. Introduction of a finite-range interaction of the calculations will perhaps lead to a better agreement. The (d,α)- and (p,α)-coincidence measurements show a strong distribution from four- and five-body final states. The results for the three-body reactions to the ^5He and ^6He ground state, respectively, in terms of Dalitz diagrams, show that in both processes two-step reactions predominate. The method of analysis further allows one to investigate-either separately or combined-contributions of resonance between different pairs of final state particles. The data give indications for peripheral deuteron breakup processes as well as for quasi-elastic scattering of the deuteron on the weakly-bound neutron in the ^9Be nucleus. (auth)

15328 (INIS-mf-1428) ENERGY AND ANGULAR CORRELATIONS IN THE (d,t)-PICKUP REACTION ON ^9Be. II. Multi-

particle Reactions Induced by Deuterons on ^{9}Be at 26.3 MeV. Sonnemans, M. A. A. (Amsterdam Univ. (Netherlands)). 3 Apr 1974. 31p. INIS.

Two-body and multi-body nuclear reaction processes, resulting from the interaction of 26.3 MeV deuterons with ^{9}Be nuclei, were studied. The experiments are performed using the measuring system "BOL" of the Institute for Nuclear Physics Research (I.K.O.) at Amsterdam, which contains 64 detection units. Results are given for the ^{9}Be(d,t)^{8}Be reaction to the ground state, the 2.9 MeV and the 16.9 MeV level. The nearly equally shaped angular distributions, the forward peaking of which points to a direct reaction mechanism, are compared with DWBA calculations, using different versions of the model. The transitions to the two lowest ^{8}Be levels are reasonably in agreement with the data, in contrast to the result for the 16.9 MeV state. Probably, this latter is connected to the large Q-value for the reaction. One of the principal aims concerns the study of the t$\alpha\alpha$-final-state. In the formation of this state prominent contributions are observed from sequential reactions through ^{8}Be* and ^{7}Li* intermediate states. The energy and angular correlation data show, apart from the resonance structure, a rather strong component of three-body disintegration, following the phase-space distribution. This points to a direct sudden breakup of the three-body system. The angular correlation data as a function of the relative α-α energy in ^{8}Be* demonstrate the importance of an $1 = 2$ angular momentum component and near the 11.4 MeV resonance even of higher impulse moments. The measurements for the ^{8}Be* system in the three-body final state are shown—as far as checked—to be in general agreement with α-α scattering data. (auth)

15329 (INIS-mf-1428) ANGULAR CORRELATION STUDY OF THE ^{9}Be(d,t)^{8}Be* 16.9 MeV → 2α. III. Multiple Particle Reactions Induced by Deuterons on ^{9}Be at 26.3 MeV. Sonnemans, M.A.A. (Amsterdam Univ. (Netherlands)). 3 Apr 1974. 21p. INIS.

Two-body and multi-body nuclear reaction processes, resulting from the interaction of 26.3 MeV deuterons with ^{9}Be nuclei, were studied. The experiments are performed using the measuring system "BOL" of the Institute for Nuclear Physics Research (I.K.O.) at Amsterdam, which contains 64 detection units. The results are given of a kinematically complete investigation on the formation and the decay of the 16.9 MeV state in ^{8}Be, through the ^{9}Be(d,t$\alpha\alpha$) reaction. This state has a characteristically small decay width of its high excitation energy in the continuum. The analysis of the angular correlation distributions is done, using a model-independent expansion of the measured correlation pattern in terms of spherical harmonics. The expansion coefficients are determined as functions of the triton angle. A first investigation within the scope of the DWBA model shows that, for this special transition, the anisotropy in the decay angular correlation allows in principle a determination of the configuration mixing in the ^{9}Be ground state of the IP-levels of the shell model, perhaps even together with the lf-shell. The triton DWBA angular distributions which strongly deviate from the data, indicate the necessity of further (partly theoretical) investigations, before the angular correlation data can be interpreted—with confidence—in terms of configuration mixing. (auth)

15330 (INS-R-133) HALF-LIFE OF ^{10}C. Robinson, D. C. (Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Physics and Engineering Lab.). Oct 1973. 52p. INIS.

The half-life of ^{10}C was measured with particular emphasis on minimization or else analytic elimination of systematic errors. The result is 19.151 ± 0.026 seconds which is almost 1½% lower than the weighted mean of previous results. This brings the ft value for the ^{10}C superallowed Fermi decay into good agreement with those of ^{14}O, ^{26m}Al and ^{34}Cl but its error remains much greater because of its imprecisely known branching ratio. (auth)

15331 (ISN-T-74-02) CONTRIBUTION TO THE INVESTIGATION OF π^- ABSORPTION AT REST IN NUCLEI. Engelhardt, H. D. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). 1974. 204p. (In French). Dep. NTIS (US Sales Only) $13.25.

Thesis.

Stopped π^- induced nuclear reactions on light and medium mass nuclei were investigated by on-line γ-spectroscopy of residual nuclei. This work is composed of a detailed bibliographical study, a complete description of the above experiment and of the experimental results of π^- absorption on ^{9}Be, ^{10}B, ^{12}C, ^{16}O, ^{19}F, ^{31}P, ^{40}Ca, and ^{93}Nb. The results show strong selectivity in populating excited states in residual nuclei and an important contribution from reaction channels corresponding to the removal of more than 2 nucleons and they suggest as a possible process π^--absorption on sub-structures, particularly of 4 nucleons, or quartets. The ratio of π^--absorption on (np) and (pp)-pairs as a function of A shows also new results. The experimental results were compared to pick-up reactions of multi-nucleon substructures and were interpreted in terms of a quasi-free interaction, including nuclear Auger effects. (auth)

15332 SEARCH FOR THE ^{19}N ISOTOPE USING THE ^{10}Be(^{11}B,2p)^{19}N REACTION. Guillaume, G.; Fintz, P.; Jundt, F.; Ordonez, I.; Gallmann, A.; Alburger, D. E.; Jones, K. W. (Centre National de la Recherche Scientifique, 67—Strasbourg (France). Centre de Recherches Nucleaires); Goosman, D. R. (Brookhaven National Lab., Upton, N. Y. (USA)). Nucl. Phys., A; 233: No. 2, 357-360(18 Nov 1974). (In French).

The ^{10}Be(^{11}B,2p)^{19}N reaction has been used to search for the ^{19}N isotope. No evidence was found for delayed γ-rays from ^{19}N(β^-)^{19}O. Delayed neutrons were observed with a half-life of 0.42 ± 0.04 s, which are tentatively assigned to the neutron emitting states in ^{19}O fed by the β-decay of ^{19}N. Analysis of the data implies allowed β-transitions to neutron emitting ^{19}O states, and makes probable an assignment of even parity for the 3.945 MeV ^{19}O state. (auth)

15333 A NEW DETERMINATION OF THE PARTIAL WIDTHS OF THE 16.11 MeV STATE IN ^{12}C. Anderson, B. D.; Dwarakanath, M. R.; Schweitzer, J. S.; Nero, A. V. (California Inst. of Tech., Pasadena (USA)). Nucl. Phys., A; 233: No. 2, 286-296(18 Nov 1974).

The partial widths of the second T = 1 state of ^{12}C, at 16.11 MeV excitation energy, have been determined by measuring the ^{11}B(p,γ) and ^{11}B(p,α) cross sections at the E_p = 163 keV resonance corresponding to this state. These measurements result in the new values of Γ_p = 21.7 ± 1.8 eV and Γ_γ = 21.6 ± 3.3 eV for the partial widths of this state, approximately 3 times smaller and larger, respectively, than the present values in the literature. The new result for the proton width eliminates a serious discrepancy found in an earlier comparison of the partial widths of the T = 1 analogue states of the A = 12 system. Measurements were also made of the ^{11}B(d,n)^{12}C* reaction to compare the proton widths of the 15.11 and 16.11 MeV T = 1 states; these measurements confirm the new, smaller proton width for the 16.11 MeV state. An attempt was also made to determine the γ-width of the 16.11 MeV state by measuring the γ-branching ratio in the ^{10}B(^{3}He,p)^{12}C*(γ)^{12}C reaction. (auth)

15334 PRECISE ENERGIES OF GAMMA RAYS FROM THERMAL NEUTRON CAPTURE IN NITROGEN. Ishaq, A. F. M.; Khan, A. M.; Anwar-Ul-Islam, M.; Najam, M. R. (Pakistan Inst. of Nuclear Science and Technology, Rawalpindi). Nucl. Instrum. Methods; 121: No. 1, 193-195(1 Oct 1974).

A consistent set of energies with improved accuracy is reported for the prominent ^{15}N gamma rays. The measurements are based on the precise value of the binding energy of the last neutron in ^{15}N derived from recent mass-spectrometric results. (auth)

15335 INVESTIGATION OF THE QUADRUPOLE DEFORMATION OF ^{11}B BY MEANS OF INELASTIC HELION SCATTERING. Aspelund, O.; Ingham, D.; Djaloeis, A.; Kelleter, H.; Mayer-Boericke, C. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik). Nucl. Phys., A; 231: No. 1, 115-119(7 Oct 1974).

The quadrupole deformation of ^{11}B was investigated by means of inelastic helion scattering at $E_{^3He}$ = 74 MeV. Optical model and coupled-channels parameters determined in this work are reported. (auth)

15336 THE EFFECT OF THE Δ(1236) ON THE CHARGE FORM FACTOR OF ^{3}He AND ^{3}H. Kallio, A. J.; Toropainen, P.; Green, A. M.; Kouki, T. (Helsinki Univ. (Finland). Research Inst. for Theoretical Physics). Nucl. Phys., A; 231: No. 1, 77-94(7 Oct 1974).

The Δ(1236) is introduced into the wave functions of ^{3}He and ^{3}H and the charge form factor (CFF) calculated. The effect is to slightly aggravate the already large discrepancy between theory and experiment for $q^2 \gtrsim 14$ fm^{-2}. However, there are two side benefits—a simple way to understand the d-wave contribution to the CFF, and a simple NΔ correlation function having a very good overlap with a more exact correlation. (auth)

15337 INVESTIGATION OF THE REACTION ^{15}N(^{3}He, α)^{14}N IN THE ENERGY RANGE $E_{^3He}$ = 2 to 4 MeV. Hunyadi, I.; Osetinskii, G. M.; Schlenk, B. (ATOMKI, Debrecen, Hungary). ATOMKI (At. Kut. Intez.) Kozlem.; 16: No. 4, 289-297(1974).

Angular distributions of the α_0, α_1, and α_2 groups from the reaction ^{15}N(^{3}He, α)^{14}N were measured in the bombarding energy range 2 to 4 MeV by using solid-state track detectors. The

angular distributions of α_0, α_1 and α_2 groups were observed at 18, 18, and 13 different bombarding energies, respectively. The integrated cross sections for the groups investigated are also presented. From the analyses of the experimental data it was concluded that, in the α_0 channel above 2.5 MeV, both compound and direct reaction processes are present; but with increase of the bombarding energy, the contribution of direct interaction increases. In the α_1 and α_2 channels compound-nucleus formation dominates in the energy range investigated. (4 figures) (auth)

15338 MOMENTUM DISTRIBUTION OF BOUND STATE PROTONS DERIVED FROM QUASI-FREE ELECTRON SCATTERING ON ^{12}C. Koebberling, M.; Moritz, J.; Schmidt, K. H.; Wegener, D.; Zeller, D. (Karlsruhe Univ. (TH) (F. R. Germany). Inst. fuer Experimentelle Kernphysik); Bienlein, J. K.; Bleckwenn, J.; Dinter, H. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)); Heimlich, F. H. (Freiburg Univ. (F. R. Germany). Fakultaet fuer Physik). Nucl. Phys., A; 231: No. 3, 504-508(21 Oct 1974).

Quasi-elastic electron scattering from ^{12}C in the range of four-momentum transfer 5 fm$^{-2} \leq q^2 \leq$ 11 fm^{-2} was measured. The momentum distribution of the bound-state protons derived from this experiment shows a large tail of high momenta. Nuclear wave functions including short-range nucleon–nucleon correlations with a parameter q_c = 300 MeV/c give a better fit to the data than pure shell-model wave functions. (auth)

15339 NEW MEASUREMENT OF THE ^{10}B(n,α)^{7}Li BRANCHING RATIO. Lamaze, G. P.; Carlson, A. D.; Meier, M. M. (National Bureau of Standards, Washington, DC). Nucl. Sci. Eng.; 56: No. 1, 94-96(Jan 1975).

To resolve a discrepancy in determinations of the ^{10}B(n,α)^{7}Li branching ratio, a new measurement was made at the National Bureau of Standards (NBS). The measurement was made with a $^{10}BF_3$ gas proportional counter and monoenergetic 790-keV neutrons obtained at the NBS 3-MV Van de Graaff laboratory. A branching ratio of 0.66 ± 0.03 was obtained. This determination agrees with the measurements of Petree et al. and Davis et al. (3 figures, 1 table) (auth)

15340 PRYAMYE REAKTSII I IZOMERNYE PEREKHODY. (Direct Reactions and Isomeric Transitions). Zaparov, E. A.; Koblik, Yu. N.; Mazitov, B. S.; Radyuk, G. A. Tashkent; Izdatel'stvo Fan Uzbekskoi SSR (1973). 152p.

The results of original studies on neutron pickup reactions during the bombardment of light nuclei with medium-energy protons were examined. Experiments on the study of the structure of the nucleus by inelastic resonance scattering of γ radiation were discussed. Data are reported on the performance of "orange" type multichannel magnetic analyzers for the study of charged particles from nuclear reactions. (35 figures, 7 tables, 109 references) (tr-auth)

15341 TOTAL NEUTRON CROSS SECTION OF CARBON FROM 1 keV TO 15 MeV. Heaton, H. T. II; Menke, J. L.; Schrack, R. A.; Schwartz, R. B. (National Bureau of Standards, Washington, DC). Nucl. Sci. Eng.; 56: No. 1, 27-36(Jan 1975).

The total neutron cross section of carbon was measured over the energy range 1 keV to 15 MeV by using the U. S. National Bureau of Standards electron linear accelerator as a pulsed neutron source. Neutron energies were measured by the time-of-flight method. The measurement accuracy is estimated to be ±¾% below 100 keV and ±1% above. The carbon cross section was fitted with a polynomial from 0.001 to 1.4 MeV with the following coefficients: $\sigma = 4.757 - 3.419E + 1.548\,E^2 - 0.328\,E^3$, where σ is in barns and E in MeV. Data are compared with other results. (6 figures, 1 table) (auth)

15342 THE ^{9}Be(d,γ_0)^{11}B REACTION IN THE REGION OF THE GIANT DIPOLE RESONANCE. del Bianco, W.; Kundu, S.; Rouben, B. (Montreal Univ., Quebec (Canada). Lab. de Physique Nucleaire). Nucl. Phys., A; 232: No. 2, 333-354(4 Nov 1974).

The 90° yield of the ^{9}Be(d,γ_0)^{11}B reaction was measured at deuteron energies ranging from 2.86 to 11.92 MeV in steps of 250 keV. Angular distributions were obtained at E_d = 2.96, 6.87, 8.89 and 9.65 MeV. The γ-rays were detected with a 23 cm × 23 cm NaI (Tl) crystal spectrometer enclosed in a plastic-scintillator anticoincidence shield. Evidence of structure was observed in the excitation curve at $E_d \sim 3.4$ and 9.65 MeV corresponding to excitation energies E_{exc} = 18.6 and 23.7 MeV, respectively. The angular distributions are typical of E1 transitions with a maximum at $\theta_L \sim 90°$. A calculation of the differential cross section of the inverse reaction, considered as a one-step direct process, gives results incompatible with the experiment and suggests that the ^{9}Be(d,γ_0)^{11}B reaction proceeds through excitation of the T = ½ component of the giant dipole resonance in ^{11}B. (auth)

15343 NEUTRON POLARIZATION FROM THE REACTION ^{9}Be(α,n)^{12}C. Dunscombe, P. B.; Maschuw, R.; Meyer-Kretschmer, G.; Miller, T. G.; Suhr, P.; Zeitnitz, B. (Hamburg Univ. (F. R. Germany). 2. Inst. fuer Experimentalphysik). Nucl. Instrum. Methods; 120: No. 3, 477-482(15 Sep 1974).

The neutron polarization from the ^{9}Be(α,n)^{12}C reaction for transitions to both the ground state and first excited state of ^{12}C has been measured over an angular range from 15° to 130° for six incident energies between 1.95 and 3.11 MeV. (auth)

15344 NEUTRON POLARIZATION FROM THE REACTION ^{14}C(d,n)^{15}N. Meyer-Kretschmer, G.; Dunscombe, P. B.; Maschuw, R.; Suhr, P.; Zeitnitz, B. (Hamburg Univ. (F. R. Germany). 2. Inst. fuer Experimentalphysik). Nucl. Instrum. Methods; 120: No. 3, 469-476(15 Sep 1974).

The polarization of the neutrons from the reaction ^{14}C(d,n_0, n_{1+2}, n_3)^{15}N was measured for deuteron energies between 2.0 and 3.3 MeV. At 2.68 and 3.00 MeV complete angular distributions up to 155° lab were determined. This was done by a neutron polarimeter with a liquid-helium scintillator. (auth)

15345 HIGH-ENERGY ELECTRON SCATTERING FROM ^{6}Li AND ^{12}C. Heimlich, F. H. (Freiburg Univ. (F. R. Germany). Fakultaet fuer Physik); Koebberling, M.; Moritz, J.; Schmidt, K. H.; Wegener, D.; Zeller, D. (Karlsruhe Univ. (TH) (F. R. Germany). Inst. fuer Experimentelle Kernphysik); Bienlein, J. K.; Bleckwenn, J.; Dinter, H. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Nucl. Phys., A; 231: No. 3, 509-520(21 Oct 1974).

The spectra of electrons scattered from ^{6}Li and ^{12}C for invariant masses of the hadronic system W ≦ 1.5 GeV and four-momentum transfers in the range 5 fm$^{-2} \leq q^2 \leq$ 12 fm^{-2} have been measured. The shape of the spectra were compared with different nuclear models. The Fermi-gas model of the nucleus cannot reproduce the data. A shell model with short-range correlations fits the data with a correlation parameter $q_c \sim$ 250 MeV/c. From the absolute cross section the effective number of nucleons was derived for quasi-elastic scattering and found to be compatible with A, whereas the effective number of nucleons derived for the excitation of the Δ(1236) resonance was found to be 0.6 A. (auth)

15346 SPIN-FLIP PROBABILITY IN THE INELASTIC SCATTERING OF 16.9 MeV NEUTRONS FROM ^{12}C. Mertens, G.; Thumm, M. (Tuebingen Univ. (F. R. Germany). Physikalisches Inst.); Geramb, H. V. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Theoretische Kernphysik). Nucl. Phys., A; 232: No. 2, 472-492(4 Nov 1974).

The neutron spin-flip probability S(θ) for inelastic scattering of unpolarized 16.9 MeV neutrons to the 4.44 MeV state of ^{12}C was determined by measuring the absolute directional correlation between the scattered neutrons and the subsequent E2 deexcitation γ-radiation emitted perpendicular to the scattering plane. Time-of-flight techniques with carbon recoil detection in a plastic scintillator were used to separate elastically and inelastically scattered neutrons. The neutron spin-flip data were found to be in close agreement with 20.0-MeV proton spin-flip results. Comparison of the measurement is made with the predictions of a microscopic antisymmetrized distorted wave calculation in which the direct reaction mechanism is supplemented by a two step resonance contribution. This theoretical analysis reveals the presence of a strong quadrupole resonance at 20.5 MeV excitation in ^{12}C. The results are also influenced to a lesser extent by the El giant dipole resonance. (auth)

15347 DISTORTED WAVE INVESTIGATION OF α-CLUSTER KNOCKOUT IN ^{6}Li. Jain, A. K.; Sarma, N. (Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.). Nucl. Phys., A; 233: No. 1, 145-152(11 Nov 1974).

Experimental results on the ^{6}Li(α,2α)^{2}H reaction at 70.3 MeV were compared with a calculation using the distorted wave impulse approximation, taking into account all exchange terms and a proper asymptotic form for the intercluster wave function. The limitation on the number of partial waves imposed by computational facilities is removed by a new prescription. Inconsistencies in the values of the clustering probability as determined by various methods are sought to be explained in terms of the contraction of the deuteron cluster in the ^{6}Li nucleus. (auth)

15348 MEASUREMENTS OF SPIN CORRELATION AND ANALYZING POWER IN d-^{3}He ELASTIC SCATTERING BETWEEN 4 AND 12 MeV. Ohlsen, G. G.; Hardekopf, R. A. (Los Alamos Scientific Lab., N. Mex. (USA)); May, D. P.; Baker, S. D.; Armstrong, W. T. (Rice Univ., Houston, Tex. (USA). Bonner Nuclear Labs.). Nucl. Phys., A; 233: No. 1, 1-8(11 Nov 1974).

Analyzing powers and spin correlation parameters were measured for d-^{3}He elastic scattering at energies E_d = 3.73 to 11.89

MeV at $\theta_{c.m.}$ = 49.5, 95.3, and 120.0°. The LASL polarized beam was incident on a polarized ^{3}He target constructed at Rice. The geometry of the experiment permitted the measurement of the parameters: A_y, A_{yy}, A_{xx}, A_{zz}, A_y^T, C_{y,y_1}, $C_{x,x}$, $C_{z,x}$, $C_{yy,y}$, and $C_{xz,y}$. The measured analyzing powers for deuterons and ^{3}He agree with earlier measurements. Some of the spin correlation parameters exhibit magnitudes which are comparable to the largest analyzing powers. (auth)

15349 PION SMALL-ANGLE MULTIPLE SCATTERING AT ENERGIES SPANNING THE (3,3) RESONANCE. Mayes, B. W.; Lee, L. Y.; Allred, J. C.; Goodman, C. (Houston Univ., Tex. (USA)); Mutchler, G. S.; Hungerford, E. V.; Scott, M. L.; Phillips, G. C. (Rice Univ., Houston, Tex. (USA). Bonner Nuclear Labs.). Nucl. Phys., A; 230: No. 3, 515-533(30 Sep 1974).

The small-angle multiple scattering of positive and negative pions has been measured for C, Al, Cu and Pb targets throughout an energy range spanning the (3,3) resonance. The measurements were made using two-dimensional multiwire proportional counters placed in the pion beam. All previous multiple scattering data for electrons and protons as well as these new data for pions are used to recalculate the empirical terms in the Moliere theory of multiple scattering. A second-order Born approximation multiple scattering theory has been devised for spin-zero particles. Modified Moliere theory gives a better fit to the experimental data than the second-order Born calculation. Because the updated Moliere theory contains much simpler equations and gives closer agreement with experiment, it is recommended in place of the more sophisticated theory for the interpretation of new experimental data. (auth)

15350 EXPERIMENTAL DETERMINATION OF THE TOTAL REACTION CROSS SECTION OF THE STELLAR NUCLEAR REACTION ^{16}O + ^{16}O. Spinka, H. (California Inst. of Tech., Pasadena (USA)); Winkler, H. (California Univ., Los Angeles (USA)). Nucl. Phys., A; 233: No. 2, 456-494(18 Nov 1974).

The total reaction cross section for ^{16}O + ^{16}O has been measured at six energies between $E_{c.m.}$ = 6.8 and 11.9 MeV. Cross sections for the production of protons, alphas, neutrons, deuterons, ^{31}S, ^{30}P, ^{12}C(g.s.) + ^{20}Ne(g.s.) and the relative γ yield were obtained with a variety of experimental methods. No ^{3}H or ^{3}He were found. All cross sections are normalized to ^{16}O + ^{16}O elastic scattering at $\theta_{c.m.}$ = 90°, which was measured separately with high precision between $E_{c.m.}$ = 7.3 and 14.4 MeV. The elastic scattering and relative γ yield of ^{12}C + ^{12}C were measured between $E_{c.m.}$ = 3.9 and 7.5 MeV. The elastic scattering and neutron yield of ^{12}C + ^{16}O were measured between $E_{c.m.}$ = 5.4 and 10.1 MeV. (auth)

15351 ON THE ANALYSIS OF THE ^{12}C(d,τ)^{11}B REACTION AT 80 MeV. Kunz, P. D.; Rost, E. (Colorado Univ., Boulder (USA). Nuclear Physics Lab.). Phys. Lett., B; 53: No. 1, 9-10(11 Nov 1974).

In a recent paper the angular distributions of the ^{12}C(d,τ)^{11}B reaction at 80 MeV were analyzed, and it was alleged that the data supported a positive deformation for ^{11}B. This large change of deformation from the usual value for ^{12}C, which is large and negative, is very surprising in that it implies a breakdown in the simple shell-model ideas that ^{11}B should be a $P_{\frac{3}{2}}$ hole coupled to the ^{12}C core. The analysis has been repeated using the conventional techniques of the coupled channels Born approximation (CCBA), and it is found that the data are not inconsistent with ^{11}B having the same deformation as ^{12}C. Further, it is argued that a large change in deformation as was reported will cause a large hindrance factor for the reaction which would be inconsistent with spectroscopic factors observed from other single-nucleon pick-up reactions on ^{12}C. (NL)

15352 INVESTIGATION OF THE SHELL MODEL STRUCTURE OF STATES IN ^{11}C AND ^{12}N WITH THE (^{3}He,n) REACTION ON ^{9}Be AND ^{10}B. Fuchs, H.; Grabisch, K.; Hilscher, D.; Jahnke, U.; Kluge, H.; Masterson, T.; Morgenstern, H. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (F.R. Germany). Bereich Kern- und Strahlenphysik). Nucl. Phys., A; 234: No. 1, 61-80(25 Nov 1974).

Absolute differential cross sections for the ^{9}Be(^{3}He,n)^{11}C and ^{10}B(^{3}He,n)^{12}N reactions have been measured for 10.5–13 MeV incident helions and lab angles up to 105°. New energy levels are reported at 10.957 ± 0.020 MeV in ^{11}C and at 7.629 ± 0.020, 8.446 ± 0.017, and 9.035 ± 0.012 MeV in ^{12}N. Transferred-L values have been suggested for most transitions. The results of DWBA calculations with both one-component wave functions and the many-component wave functions of Cohen and Kurath are compared with the experimental data. The dominant jj coupling components of several states have been determined. Analog states in the A = 12 triad are suggested. (auth)

15353 DEPOLARIZATION AND THE SPIN–SPIN INTERACTION IN p–^{9}Be ELASTIC SCATTERING. Birchall, J.; Conzett, H. E.; Arvieux, J.; Dahme, W.; Larimer, R. M. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Phys. Lett., B; 53: No. 2, 165-167(25 Nov 1974).

The D-parameter was determined to be less than 1.0 at four angles in p–^{9}Be elastic scattering at 25 MeV. These results strengthen considerably the evidence for the existence of a nucleon–nucleus spin–spin interaction. (auth)

15354 ANALYZING POWER OF THE ^{6}Li(p,pα)^{2}H REACTION: A NEW TEST FOR REACTION MECHANISMS. Durand, J. L.; Arvieux, J.; Perrin, C.; Perrin, G. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Phys. Lett., B; 53: No. 1, 57-59(11 Nov 1974).

The cross section and analyzing power of the ^{6}Li(p,pα)^{2}H three-body reaction have been measured for seven angles of the p–α quasi-free system. The sensitivity of this type of measurement as a test of the reaction mechanism is emphasized. (auth)

15355 MULTICHARGED PARTICLE EMISSION IN THE DISINTEGRATION OF CARBON INDUCED BY HIGH-ENERGY ELECTRONS. Baroni, G.; Di Liberto, S.; Petrera, S.; Romano, G. (Rome Univ. (Italy). Istituto di Fisica). Nucl. Phys., A; 231: No. 3, 521-532(21 Oct 1974).

The disintegration of carbon nuclei by 800- and 1000-MeV electrons is studied by using plastic detectors. Angular and energy distributions of the emitted Li, Be and B isotopes are presented. In the absence of a clear theoretical model the consistency of the results with an isotropic emission by a moving excited nucleus is analyzed. (auth)

15356 ON THE PRACTICAL APPLICATION OF THE GENERALIZED R-MATRIX METHOD TO PROBLEMS IN NUCLEAR PHYSICS. Philpott, R. J.; George, J. (Florida State Univ., Tallahassee (USA). Dept. of Physics). Nucl. Phys., A; 233: No. 1, 164-184(11 Nov 1974).

The role of the generalized R-matrix method as a calculational tool applicable to a large class of problems in nuclear physics is examined. The rapid convergence observed when the channel radii are held constant can be further improved if the channel radii are allowed to vary. A criterion is proposed which governs the selection of an optimal set of channel radii. The absolute convergence of the method obtained when the criterion is employed is demonstrated by explicit calculations performed for (i) a Woods-Saxon potential model of ^{16}O + n scattering, (ii) a coupled channels model of ^{12}C + n scattering, and (iii) a microscopic model of ^{14}C + n scattering. The methods introduced provide the means for a systematic treatment of the convergence of the method, enabling optimal accuracy to be obtained from any given set of basis functions. In addition, a fair indication of the accuracy of the final result is obtained. (auth)

15357 CHARGE-EXCHANGE REACTION ON ^{12}C WITH 217 MeV ^{3}He PARTICLES. Willis, N.; Brissaud, I.; Bimbot, L.; Le Bornec, Y.; Tatischeff, B. (Paris-11 Univ., 91 – Orsay (France). Inst. de Physique Nucleaire). Nucl. Phys., A; 233: No. 1, 121-132(11 Nov 1974).

Differential cross sections for the (^{3}He,t) charge-exchange reaction were measured on a ^{12}C target with 217 MeV ^{3}He particles. High energy tritons were detected using a thick Ge(Li) crystal (43 mm) and a 4 mm Si(Li) detector in an E-ΔE telescope. Microscopic DWBA calculations were carried out, using the rather well known wave functions of the ^{12}C levels from Gillet and Vinh-Mau. The sensitivity of this reaction to the different terms of the two-body effective interaction is discussed. A comparison of the (^{3}He,t) and (^{3}He,^{3}He′) reactions populating analog final states is also presented. The two-step mechanisms (^{3}He,α)(α,t) and (^{3}He,d)(d,t) are introduced for the first two levels 1^+ (g.s.) and 2^+(0.969 MeV) and the results emphasize the importance of such processes at high energy. (auth)

15358 AN ANALYSIS OF PION–NUCLEUS SCATTERING LENGTHS WITHIN AN α-CLUSTER MODEL. Huefner, J. (Max-Planck-Institut fuer Kernphysik, Heidelberg (F. R. Germany)); Tauscher, L.; Wilkin, C. (European Organization for Nuclear Research, Geneva (Switzerland)). Nucl. Phys., A; 231: No. 3, 455-461(21 Oct 1974).

Pion–nucleus s-wave scattering lengths are calculated from a multiple scattering series in terms of the $\pi-\alpha$ scattering length. Agreement on the level of 10–20% with the values obtained from mesic-atom data is achieved for all nuclei with $A \leqq 20$. This result lends weight to the speculation that pion absorption on light nuclei takes place primarily on α-particle substructures. (auth)

15359 STATISTICAL MODEL DESCRIPTION OF THE SYSTEM ^{12}C + ^{14}N IN AGREEMENT WITH EXPERIMENT FOR

E_{lab} = 20–120 MeV. Klapdor, H. V.; Reiss, H.; Rosner, G. (Max-Planck-Institut fuer Kernphysik, Heidelberg (F.R. Germany)). Phys. Lett., B; 53: No. 2, 147-150(25 Nov 1974).

Statistical model calculations for the two experimentally best known channels $^{6}Li + ^{20}Ne$ and $d + ^{24}Mg$ of the reaction $^{12}C + ^{16}N \rightarrow x + y$ are in excellent agreement with experiment over a range of 100 MeV in bombarding energy. The method for prediction of the high spin selectivity of heavy ion compound reactions was refined by taking into account the Q-value dependence of the total cross section. At high bombarding energies the "optimum Q-value" is very sensitive to the critical L-value of the compound nucleus. (auth)

15360 REALISTIC CALCULATIONS OF THE $(\pi^-,n\gamma)$ REACTION. Lee, T. S. H. (Bartol Research Foundation, Swarthmore, Pa. (USA)); Vergados, J. D. (Pennsylvania Univ., Philadelphia (USA). Dept. of Physics). Phys. Lett., B; 53: No. 2, 125-128(25 Nov 1974).

The $(\pi^-,n\gamma)$ reaction was investigated within the direct reactions formalism employing the CGLN interaction and realistic nuclear and distorted neutron wave functions. The results for ^{14}N can account for the quasifree background observed in radiative capture of stopped pions, but they predict gross structure. Comparisons with the phenomenological pole model are made. (auth)

15361 OPTICAL MODEL ANALYSIS OF PION ELASTIC SCATTERING BY ^{3}He. Mach, R.; Nichitiu, F.; Scherbakov, Yu. A. (Joint Inst. for Nuclear Research, Dubna (USSR)). Phys. Lett., B; 53: No. 2, 133-135(25 Nov 1974).

In the framework of the multiple scattering theory, the first order optical potential was derived. The potential contains spin and isospin dependent terms and terms arising due to the inclusion of the Fermi motion as well. Pion elastic cross sections were calculated for ^{3}He nucleus, using this optical model, at energies 97 and 154 MeV. Especially for π^+ mesons reactions, good qualitative agreement was found between experimental and theoretical cross sections. Different behavior of π^+ and π^- elastic cross sections was explained. (auth)

15362 EXCHANGE EFFECTS IN THE $^{7}Li(^{3}He,\alpha)^{6}Li$ REACTION. Werby, M. F.; Edwards, S. (Florida State Univ., Tallahassee (USA). Dept. of Physics). Nucl. Phys., A; 234: No. 1, 1-12(25 Nov 1974).

Angular distributions of α-particles from the $^{7}Li(^{3}He,\alpha)^{6}Li$ reaction at ^{3}He bombarding energies of 16 and 18 MeV are analyzed with an exact finite-range two-mode DWBA formalism by using the computer code FANLU2. It is demonstrated that within the formalism used it is essential to include the exchange mode of the reaction. The overall features of the angular distributions are described remarkably well, but a strong dependence on optical-model parameter sets makes it essential to adhere to a characteristic class of such sets. Spectroscopic factors for direct and exchange modes are extracted and discussed. (auth)

15363 ASYMMETRY AND POLARIZATION OF THE RECOIL NUCLEUS IN THE REACTION $\mu^- + ^{12}C \rightarrow ^{12}B + \nu_\mu$. Devanathan, V.; Subramanian, P. R. (Madras Univ. (India). Dept. of Nuclear Physics). Phys. Lett., B; 53: No. 1, 21-24(11 Nov 1974).

Expressions for the resultant polarizations of ^{12}B nuclei obtained in the experimental arrangement of Louvain–Saclay collaboration are derived. How these polarizations are related to the average polarization, the longitudinal polarization and the nuclear recoil asymmetry is investigated. (auth)

Nuclear Properties and Reactions, 20 ≤ A ≤ 38

Refer also to abstracts 15331, 15349, 15358, 15416, 15420, 15476, and 15547.

15364 (BNL-19194) NUCLEAR LIFETIMES. Warburton, E. K. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 26p. (CONF-740934-3). Dep. NTIS $4.50.

From international conference on nuclear structure and spectroscopy; Amsterdam, Netherlands (9 Sep 1974).

Recent activities in the measurement of the lifetimes of bound nuclear levels by using "in-beam" techniques are reviewed. First, the subjects of direct timing by pulsed beams and the associated-particle techniques are briefly discussed. Next, the Doppler shift method and the problem of stopping power uncertainties in this type of measurement are addressed. Then the recoil distance method is considered: recent technical advances, the area of greatest activity, and unsolved problems are examined. Coulomb excitation is touched upon, and the paper concludes by treating the field of shape isomers in fission. (24 figures, 1 table) (RWR)

15365 (COO-535-710, pp 38-40) $^{24}Mg(d,\alpha)^{22}Na$. Schneider, M. J.; Olness, J. W. 1 Nov 1974.

In technical progress report, November 1, 1973–November 1, 1974.

15366 (COO-535-710, pp 45-46) CHARGE-EXCHANGE ANALOGS OF THE GIANT M-1 RESONANCES IN ^{24}Mg AND ^{28}Si. Peterson, R. J.; Ristinen, R. A.; Fritts, M. J.; Stein, N.; Flynn, E. R.; Sherman, J. 1 Nov 1974.

In technical progress report, November 1, 1973–November 1, 1974.

15367 (COO-2130-119, pp 77-123) STRUCTURE IN THE NUCLEAR CONTINUUM: HEAVY IONS AS NUCLEAR PROBES. Bromley, D. A. 1973.

In heavy ion lecture series. Volume I.

The subject of this lecture is a set of states high in the continuum region with widths of about 10 keV. As these states have a rather peculiar structure, there is little overlap with the continuum state; their high spin means that decay is inhibited and lifetime is long. The talk is devoted to ^{24}Mg, produced principally in the $^{12}C + ^{16}O$ reaction. Various cross sections are exhibited, and the kinematics of the reaction are discussed. (50 figures) (RWR)

15368 (FRNC-TH-492) β^- DECAY OF ^{26}Na, ^{30}Al, ^{37}S, AND ^{40}Cl NUCLEI FORMED IN (n,p) REACTIONS. Klotz, G. (Strasbourg-1 Univ., 67 (France)). 1973. 182p. (In French). Dep. NTIS (US Sales Only) $12.25.

Thesis.

Neutron rich (2s-1d) shell nuclei formed in (n,p) reactions with fast neutrons were studied. Two types of investigation were made: studies of processes directly related to the interaction between projectiles and the target by scattering or reactions (recoil nucleus spectroscopy); studies of the decay of the products formed (generally β^- emitters) by the detection of the γ radiation associated with decay to the ground state. Most of the work undertaken concerned the second type of investigation for four proton deficient nuclei: ^{26}Na, ^{30}Al, ^{37}S, and ^{40}Cl. A pneumatic sample transfer system was developed for the automatic repetition of activation-analysis cycles for the case of short half-life radioactivities. The information provided by the junction was recorded using an on-line computer and the multispectrum technique. The following aspects of the four β^- decays were studied: intensity of β^- branchings towards the excited states of the resulting nuclei; the corresponding comparative half-lives; the characteristics of the γ lines associated with these decays. The ^{26}Na and ^{30}Al odd-odd nuclei (cross-conjugate) were studied theoretically, the angular momentum being predicted in terms of the particle configurations using j–j coupling model. Analysis of the radioactivity of ^{37}S and ^{40}Cl provided information on the excitation states populated in the resulting nuclei (^{36}Cl and ^{40}Ar). (auth)

15369 (IFA-R-10-1974) $^{27}Al(n,\alpha)^{24}Na$ CROSS SECTION EVALUATION OF EXPERIMENTAL DATA. Part I. Vasiliu, G. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 35p. Dep. NTIS (US Sales Only) $4.75.

Investigating most of the existing literature on $^{27}Al(n,\alpha)^{24}Na$ reaction, through 1973 an evaluation of the cross sections was done for this reaction from threshold to 20 MeV, using the up-to-date standards. A maximum value of 128.13 mb was found for the cross section at 13.52 MeV. Using the evaluated curve, the microscopic integral cross section of the $^{27}Al(n,\alpha)^{24}Na$ reaction averaged in ^{235}U thermal fission spectrum, was computed, on the basis of the simple fission spectrum formula. The value which was found is 0.732 mb for a spectrum "temperature" of 1.305 MeV. (auth)

15370 (INIS-mf-1279) STUDY OF THE REACTION $^{10}B(^{16}O,\alpha)^{22}Na$. Gomez del Campo, E. J. (Universidad Nacional Autonoma de Mexico, Mexico City. Facultad de Ciencias). 1973. 29p. (In Spanish). INIS.

Thesis.

Levels in ^{22}Na were studied by means of the $^{10}B(^{16}O,\alpha)^{22}Na$ reaction using a ^{16}O beam of the tandem Van de Graaff accelerator of ORNL in order to establish the reaction mechanisms involved and to identify the populated high spin states in the residual nucleus. By the use of a position-sensitive detector 60 cm in length placed at the focal surface of an Enge split pole type magnet, 47 levels of ^{22}Na up to an excitation energy of 14 MeV were observed. The excitation functions at an angle of 7° with bombardment energies between 40 and 46 MeV and the angular distributions at a bombardment energy of 46 MeV were measured for these levels. From an analysis of the fluctuation of the excitation functions

and from the fact that the angular distributions are symmetric at 90° center of mass, it was established that the reaction mechanism is predominantly a compound nucleus reaction. The experimental results were compared with statistical calculations using the Hauser–Feshbach theory. A good agreement between theory and experiment was obtained. Candidates for the high spin members 8^+, 9^+, and 10^+ of the rotational band of the ground state and 7^+ and 9^+ of the $K = 0^+$ rotational band were suggested. States whose excitation energies and spin are consistent with calculations of the shell model and Hauser–Feshbach calculations were selected. (tr-auth)

15371 (INIS-mf-1389) EXPERIMENTAL STUDY OF LOW-LYING LEVELS OF ^{28}Al. Boerma, D. O. (Rijksuniversiteit Groningen (Netherlands)). 5 Jun 1970. 113p. INIS.

The Groningen-5-MV Van de Graaff accelerator was rebuilt to a large extent, and a beam handling system was designed and constructed for nuclear physics investigations. Particle-gamma coincidence measurements were made using the ^{27}Al(d,pγ)^{28}Al, ^{26}Mg(^{3}He,pγ)^{28}Al and ^{30}Si(d,αγ)^{28}Al reactions. From these measurements gamma-decay schemes and accurate branching ratios for the first twelve excited states of ^{28}Al were obtained. For the detection of the gamma-rays a Ge(Li) detector had to be used. The instrumentation for the gamma-ray spectroscopy is described. It was worked out quantitatively using the statistical theory of nuclear reactions that the yields of the ^{30}Si(d,α)^{28}Al reaction measured at 180° is a sensitive function of the spin and parity of the final level. A comparison of measured yields with calculated yields using this theory for levels with known spin and parity showed quantitative agreement in all cases. A comparison of the results with the predictions of (incomplete) shell-model calculations gives the impression that the levels in ^{28}Al up to 3 MeV excitation energy can be described very well with rather simple shell-model configurations. Using the obtained information on ^{28}Al and the existing literature on the properties of levels in ^{28}Si some isobaric analog states were identified, whereas for several other states a tentative T = 1 assignment could be made. (auth)

15372 (INIS-mf-1403) PROPERTIES OF LEVELS IN ^{35}Cl STUDIED BY MEANS OF THE ^{32}S(α,pγ)^{35}Cl REACTION. Ingebretsen, P. (Oslo Univ. (Norway). Fysisk Institutt). 1972. 115p. INIS.

Thesis.

The reaction ^{32}S(α,pγ)^{35}Cl was used to measure properties of levels in ^{35}Cl below 6.40 MeV excitation. Fifteen new levels, not reported in the compilation of Endt and van der Leun, were observed. Level energies, spins, mean lifetimes, gamma-ray branching ratios and gamma-ray multipole mixing ratios were measured by angular correlations and Doppler shift techniques. Gamma-ray transition strengths were deduced, and the parity of some levels was found. The data has provided stringent tests of nuclear model calculations. The applicability of the angular correlation method was studied in detail. It is shown that the statistical tensors which describe the alignment of a gamma emitting state must lie within physical limits which depend on the number of magnetic substates populated. A consequence of this is that any measured angular correlation can in principle be analyzed when statistical tensors are used as free parameters. Furthermore, it is shown that some angular correlation measurements cannot distinguish between different a priori possible level spins. Some of these ambiguities can be resolved from the angular correlation of gamma-rays further down in a cascade. The positive parity levels below 4 MeV excitation are found to constitute three bands. These are described in terms of the Nilsson model involving orbits 8, 11 and 9, where the rotational-particle coupling is taken into account. The model gives a good description of the level energies and the E2 transition strengths. The log ft, values of positron decay from ^{35}Ar, the M1 transition strengths and the single proton stripping spectroscopic factors are in qualitative agreement with experiment. The main deficiency of the model as applied to ^{35}Cl is attributed to an over-estimation of the orbit 9 hole component in the band built on the first excited $\frac{1}{2}^+$ state. The existence of rotational modes of excitation of ^{35}Cl is somewhat surprising, because there is some evidence for vibrational structure in the even-even nuclei above ^{28}Si. However, the rotational model was also applied to the T = $\frac{1}{2}$ ^{29}P and ^{29}Si nuclei with some success and calculations along these lines can still be refined. (auth)

15373 (IPNO/TH-73-7) HIGH ENERGY REACTIONS AND NUCLEAR DENSITIES. Auger, J. P.; Lombard, R. J. (Paris-11 Univ., 91–Orsay (France). Inst. de Physique Nucleaire). Jun 1973. 65p. Dep. NTIS (US Sales Only) $6.50.

Two kinds of nuclear densities, corresponding to two different approaches to the nuclear many-body problem and characterized by two different surface shapes are used to calculate high energy reactions. The calculations are made in the framework of the multiple scattering theory. It is shown that proton-nucleus elastic scattering is suitable to study the surface shape of particle distributions in nuclei. Low resolution experiments in which the total differential scattering cross is measured are sensitive to radii and not to details of nuclear densities. Particle production processes are also briefly discussed. (auth)

15374 COMPARATIVE STUDY OF THE VMI MODEL EXPRESSIONS FOR THE FITTING OF THE ROTATIONAL SPECTRUM OF A SINGLE INTRINSIC WAVE FUNCTION. Ullah, N. (Tata Inst. of Fundamental Research, Bombay (India)). Nucl. Phys., A; 233: No. 1, 230–236(11 Nov 1974).

Skyrme's method is used to introduce a correlation coefficient which tells which of the VMI model expressions should be considered better in the calculation of the projected energies E_J when one uses a single intrinsic wave function for a set of good J-states. As an application of the correlation coefficient, it was shown that out of several VMI model expressions for the energy which have the same overlap with the Hamiltonian, the one having minimum dispersion should be considered to be the best choice. A remark is passed that the Holmberg-Lipas model can also be derived using Bohr and Mottelson's conditions. Numerical calculations are carried out for the nuclei ^{28}Si and ^{36}Ar using Ripka's Hartree-Fock wave functions to compare Holmberg-Lipas model with the one in which one directly expands the energy E_J in powers of J(J + 1), where J is the total angular momentum. (auth)

15375 SYSTEMATICS OF ENERGIES OF PARTICLE–HOLE STATES IN THE 2s–1d AND 1$f_{\frac{7}{2}}$ SHELLS. Sherr, R.; Kouzes, R.; Del Vecchio, R. (Princeton Univ., N. J. (USA). Joseph Henry Labs.). Phys. Lett., B; 52: No. 4, 401–406(28 Oct 1974).

The systematics of particle–hole states in the 2s–1d and 1$f_{\frac{7}{2}}$ shells have been analyzed in terms of the Bansal–French–Zamick weak-coupling method. States considered are $d_{\frac{5}{2}}^{-1}$ $f_{\frac{7}{2}}^n$ ($J = \frac{3}{2}^+$), $(s-d)^n$ $f_{\frac{7}{2}}$ ($J = \frac{7}{2}^-$) and $(s-d)^n$ $f_{\frac{7}{2}}^2$ ($J = 0^+$ and 7^+), the j^n components corresponding to even-even ground states. (auth)

15376 TWO-PHONON STATES IN DOUBLY EVEN NUCLEI WITH $30 \leq Z \leq 52$. Hadermann, J. (Bonn Univ. (F. R. Germany). Inst. fuer Theoretische Kernphysik); Rester, A. C. (Bonn Univ. (F. R. Germany). Inst. fuer Strahlen- und Kernphysik). Nucl. Phys., A; 231: No. 1, 120–140(7 Oct 1974).

Results of a survey of energies of two-phonon states are presented. Systematic trends are extracted and parametrized with the anharmonic vibrator model. The doubly even nuclei with anomalous 0^+ first excited states are fitted into a general pattern indicating profound influence of both proton and neutron shell closure on the lowering of the $0^{+\prime}$ state energies. A sharp transition from anharmonic vibrational to almost pure rotational motion in this nuclear region is suggested for nuclei with first excited 2^+ state energy ~130 keV. Such a possible transition and similar ones already well known in the rare earth and heavy element regions are well described by the model. (auth)

15377 DETERMINATION OF THE l-VALUE OF NUCLEON RESONANCES FROM THEIR FORMATION IN DEUTERON STRIPPING AND COMPARISON WITH THE TOTAL NUCLEON CROSS SECTION. Bommer, J.; Ekpo, M.; Fuchs, H.; Grabisch, K. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (F. R. Germany). Bereich Kern- und Strahlenphysik); Oeschler, H. (Max-Planck-Institut fuer Kernphysik, Heidelberg (F. R. Germany)). Phys. Lett., B; 52: No. 4, 421–424(28 Oct 1974).

Proton spectra from the ^{24}Mg(d,p) and ^{32}S(d,p) reactions leading to unbound states of ^{25}Mg and ^{33}S and the total neutron cross section of ^{24}Mg from 1.0 to 5.2 MeV have been measured. The ratio of the (d,p) strength and the total neutron cross section depends strongly on the orbital angular momentum of the unbound state. The l-values of 20 resonances are determined. The (d,n) reactions on ^{12,13,14}C studied at 6.5 MeV and compared with (p,p_0) reveal a similar l-dependence for proton resonances. (auth)

15378 INVESTIGATION OF THE REACTION ^{35}Cl(τ,α)^{34}Cl AT E_τ = 15 MeV. van Gasteren, J. J. M.; Sikora, B.; van der Steld, A. (Rijksuniversiteit Utrecht (Netherlands). Fysisch Lab.). Nucl. Phys., A; 231: No. 3, 411–424(21 Oct 1974).

The ^{35}Cl(τ,α)^{34}Cl reaction has been used to study the properties of ^{34}Cl levels up to an excitation energy of 5 MeV. Angular distributions of 37 levels were measured with a split-pole magnetic spectrograph, at a bombarding energy of 15 MeV. New levels have been found at 3847, 3964, 4206, 4321 and 4715 keV, all ± 10 keV. There is a strongly excited multiplet at E_x = 5.0 MeV with components at 4939 ± 11, 4958 ± 11, 4971 ± 11, 4998 ± 12 and 5010 ± 13 keV. A DWBA analysis of the α-particle angular distributions yielded l_n values and spectroscopic factors. New spin and parity assignments were obtained. The T = 1 character of

the levels at E_x = 4.21 and 4.72 MeV has been determined. Experimental spectroscopic factors are compared with results from recent many-particle shell-model calculations. (auth)

15379 RESONANT STRUCTURES IN THE EXCITATION FUNCTIONS OF ELASTIC AND INELASTIC SCATTERING OF ^{16}O ON ^{24}Mg. Mittig, W.; Charles, P.; Lee, S. M.; Badawy, I.; Berthier, B.; Fernandez, B.; Gastebois, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 – Gif-sur-Yvette (France). Service de Physique Nucleaire a Basse Energie). Nucl. Phys., A; 233: No. 1, 48-54(11 Nov 1974).

Excitation functions of $^{24}Mg(^{16}O, ^{16}O)^{24}Mg$ were studied between 25 and 64 MeV incident energy. A strongly resonant behavior was observed for inelastic scattering at backward angles. The data were analyzed in terms of coupled channel calculations. While agreement was good at forward angles, at backward angles the calculated cross sections are an order of magnitude too low suggesting that another reaction mechanism or neglected terms in the heavy ion interaction potential are important. (auth)

15380 ELASTIC SCATTERING OF 9-13 MeV VECTOR POLARIZED DEUTERONS. Lohr, J. M.; Haeberli, W. (Wisconsin Univ., Madison (USA)). Nucl. Phys., A; 232: No. 2, 381-397 (4 Nov 1974).

Angular distributions of the cross section and vector analyzing power were measured for elastic scattering of 9, 11 and 13 MeV deuterons from ^{27}Al, Si, ^{46}Ti, ^{48}Ti, ^{53}Cr, ^{64}Zn, ^{90}Zr and ^{120}Sn. The results were analyzed with the optical model. The analysis also included results from similar previous experiments on 18 nuclides for deuteron energies between 5 and 12.3 MeV. Good agreement with most of the measurements was obtained by adjusting only the parameters of the absorptive part of the potential from one nucleus to the next. All other parameters were held constant, except for the real potential depth which was assumed to depend on $Z/A^{1/3}$. The volume integral of the imaginary potential seems to be correlated with the deformation parameter. (auth)

15381 INVESTIGATION OF THE $^{31}P(\tau,\alpha)^{30}P$ REACTION AT E_τ = 15 MeV. van Gasteren, J. J. M.; Verhage, A. J. L.; van der Steld, A. (Rijksuniversiteit Utrecht (Netherlands). Fysisch Lab.). Nucl. Phys., A; 231: No. 3, 425-436(21 Oct 1974).

Angular distributions of α-particle groups, corresponding to 34 levels observed in the reaction $^{31}P(\tau,\alpha)^{30}P$ at E_τ = 15 MeV, have been measured with a split-pole magnetic spectrograph equipped with position-sensitive detectors. New ^{30}P levels were found at 5890 ± 12, 5930 ± 8, 6050 ± 10 and 6090 ± 6 keV. For 27 levels the l_n value could be deduced. Experimental spectroscopic factors from a DWBA analysis are compared with those from recent many-particle shell-model calculations. (auth)

15382 MULTIPLE-SCATTERING CORRECTIONS IN BACKWARD SCATTERING OF NEUTRONS. Minetti, B.; Pasquarelli, A. (Politecnico di Torino (Italy)). Nucl. Instrum. Methods; 120: No. 3, 509-514(15 Sep 1974).

The multiple-scattering corrections for neutron scattering at angles greater than 140° are presented. The total fraction of neutrons which are scattered once or twice in the target in the case of both elastic and inelastic (first excited level) scattering can be evaluated for any backward angle. Monte Carlo random-walk techniques are used. The program includes the effect due to energy loss by the neutrons following the scattering, together with the corresponding dependence on energy and angle of the cross sections for all types of collisions. The geometry considered is particularly suited for backscattering experiments where extended targets must be used. The illustrative example of the reaction $^{32}S(n,n')^{32}S$ is presented. (auth)

15383 MULTIPOLE DEFORMATIONS IN ^{19}F AND IN THE NEON ISOTOPES AND ELECTRIC MULTIPOLE STRENGTH IN ^{19}F FROM INELASTIC SCATTERING OF 30 MeV PROTONS. De Swiniarski, R.; Genoux-Lubain, A.; Bagieu, G.; Cavaignac, J. F. (Institut des Sciences Nucleaires, Grenoble, France). Can. J. Phys.; 52: No. 23, 2422-2435(1 Dec 1974).

Cross sections were measured for inelastic scattering of 30 MeV protons from ^{19}F, ^{20}Ne, ^{21}Ne, and ^{22}Ne. The cross sections of the ground-state rotational band in these nuclei were analyzed in the coupled channels formalism and yield further evidence for a large hexadecapole deformation in ^{19}F (β_4 = 0.14 ± 0.04) and in ^{20}Ne (β_4 = 0.28 ± 0.05) in good agreement with several recent proton inelastic scattering experiments. These calculations show also that the Y_4 moment is small or close to zero in ^{21}Ne and ^{22}Ne ($\beta_4 \leq 0.05$). The analysis of the available ^{19}F cross section in the DWBA formalism shows evidence for a large and significant octupole transition strength for the 1.35 MeV ($\frac{1}{2}^-$) (3.6 W.u.), the 5.43 MeV ($\frac{1}{2}^-$) state (6.70 W.u.), and the 5.63 MeV ($\frac{1}{2}^-$) state (3.60 W.u.). The measured transition strengths are generally in disagreement with recent low-energy (α,α') or (d,d') results but also with the earlier Coulomb excitation measurements. Thus, we confirm that a major discrepancy still exists between inelastic scattering and Coulomb excitation of the octupole transition strength to several states in ^{19}F but mainly to the 1.35 MeV ($\frac{1}{2}^-$) state, as was already pointed out some time ago from a low-energy inelastic proton scattering experiment. (auth)

15384 THE ENERGY LEVELS OF ^{26}Al. De Neijs, E. O.; Meyer, M. A.; Reinecke, J. P. L.; Reitmann, D. (Potchefstroom Univ. for C.H.E. (South Africa)). Nucl. Phys., A; 230: No. 3, 490-508(30 Sep 1974).

The energies and strengths of $^{25}Mg(p,\gamma)$, $^{25}Mg(p,p_1)$ and $^{25}Mg(p,p_2)$ resonances were determined in the energy range E_p < 2 MeV. Four new (p,γ) resonances were observed at E_p = 736.2 ± 0.7, 818.1 ± 0.7, 834.6 ± 0.7 and 1514.7 ± 0.7 keV. The γ decay of 44 resonances and 49 bound levels was established. The energies of 41 and mean lifetimes of 25 bound levels were determined. Two new levels at E_x = 4952.4 ± 1.4 keV and 5141.7 ± 2.0 keV were observed. Angular distributions yielded unique spins for five resonance levels. Weisskopf estimates allowed unique spin assignments for five resonances. The Q-value of the $^{25}Mg(p,\gamma)$ ^{26}Al reaction was found to be 6305.0 ± 1.2 keV. (auth)

15385 STUDY OF THE (^{12}C, ^8Be(g.s.)) REACTION AND FOUR-NUCLEON TRANSFER ON ^{24}Mg. Ho, H.; Duennweber, W.; Dehnhard, D.; Mudersbach, K.; Wurm, J. P. (Max-Planck-Institut fuer Kernphysik, Heidelberg (F. R. Germany)). Nucl. Phys., A; 233: No. 2, 361-372(18 Nov 1974).

The (^{12}C,^8Be(g.s.)) reaction on ^{12}C and ^{24}Mg was investigated at 31.8 MeV using a four-counter arrangement for coincident detection of the ^8Be break-up alpha particles. A special geometry is described which optimizes the detection efficiency for ^8Be(g.s.) and is only smoothly energy dependent. The kinematically complete measurement allows discrimination against other coincidence events. Among these the sequential α decay shows up strongly in the case of ^{12}C + ^{12}C, much less so in ^{12}C + ^{24}Mg. Seventeen levels or groups of levels were populated in ^{28}Si up to E_x = 16 MeV, the most prominent at E_x = 6.9, 9.7, 10.2 and 11.0 MeV with cross sections of 20 to 70 μb/sr at 45° lab. The observed selectivity resembles that of the reactions (^6Li,d), (^7Li,t) and (^{16}O,^{12}C) studied recently. (auth)

15386 INVESTIGATION OF 1p-2h STATES IN ^{39}K WITH THE $^{38}Ar(^3He,d)^{39}K$ REACTION. Knoepfle, K. T.; Doll, P.; Mairle, G.; Wagner, G. J. (Max-Planck-Institut fuer Kernphysik, Heidelberg (F. R. Germany)). Nucl. Phys., A; 233: No. 2, 317-328(18 Nov 1974).

The 1p-2h aspect of ^{39}K states was examined by means of the $^{38}Ar(^3He,d)$ reaction at E(^3He) = 24 MeV. Angular distributions for 17 states up to an excitation energy of 7 MeV have been measured and analyzed with DWBA calculations to determine the transferred angular momentum and spectroscopic factors. Almost the complete transition strengths have been observed for $1f_{7/2}$ and $2p_{3/2}$ states in ^{39}K with T = 1/2. The isobaric analog state of the ^{39}Ar ground state with $J^\pi = \frac{1}{2}^-$ was found at an excitation energy of 6547 ± 15 keV. The spectroscopic results represent a sensitive test of shell-model wave functions calculated previously by several authors. (auth)

15387 A STUDY OF THE ENERGY STATES OF ^{31}P BY MEANS OF THE $^{30}Si(p,\gamma)^{31}P$-REACTION IN THE ENERGY FIELD Ep = 1.2 TO 2 MeV. Rossouw, R. S. (Potchefstroom Univ. for C. H. E. (South Africa)). 1972. 76p. (In Afrikaans). INIS.

31 refs.; copies available from Atomic Energy Board, Pelindaba, Pretoria (South Africa).

The following information was obtained during this experiment: the gamma-decay of 19 resonances was determined in the Ep = 1.2 to 2 MeV energy region; the gamma-decay of 38 bound levels was studied and the branching ratios of these levels were established; the energies of the bound states above 5.02 MeV were determined from spectra which were recorded at 55°; mean lifetimes of 6 levels were measured by means of the Doppler shift attenuation method; the transition strengths of 22 transitions were determined; uneven parities were obtained for the Ep = 1595, 1918 and 1971 KeV resonances by means of Weisskofp estimates; new levels were observed with energies E_x = 6078.5 ± 2; 6460.6 ± 1.7; 6931.4 ± 1.3 and 7313.7 ± 1.6 keV. (INIS)

15388 SPECTROSCOPY OF THE CONTINUUM STATES OF ^{24}Mg USING THE $^{20}Ne(\alpha,\alpha')$ AND $^{23}Na(p,\alpha)$ REACTIONS. Ballini, R.; Cindro, N.; Fouan, J. P.; Kalbach, C.; Lepareux, M.; Saunier, N. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Physique Nucleaire). Nucl. Phys., A; 234: No. 1, 33-52(25 Nov 1974).

Excitation functions have been measured for the $^{20}Ne(\alpha,\alpha')^{20}Ne$ and $^{23}Na(p,\alpha)^{20}Ne$ reactions in the energy ranges corresponding

to, respectively, 17.85–21.67 and 19.35–20.65 MeV of excitation in ^{24}Mg, that is, in the region of the sub-Coulomb resonances in ^{24}Mg observed in the ^{12}C + ^{12}C reactions. By using statistical analysis techniques the energies of possible quasibound states in ^{24}Mg responsible for the deviations from the average trends in the above excitation functions have been determined and compared to the energies of known sub-Coulomb resonances in ^{24}Mg. The comparison speaks in favor of interpreting the simple structures associated with the resonances as alpha-like configurations in the ^{24}Mg continuum. (auth)

15389 THE HARTREE–FOCK AND THE RANDOM PHASE APPROXIMATIONS APPLIED TO Ne^{20}, Si^{28} AND Ar^{36}. Energy Levels and E2 Transitions. de Oliveira, D. R. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). Rev. Brasil. Fis.; 1: No. 3, 403-428(Dec 1971).

The Hartree–Fock approximation was applied to ^{20}Ne, ^{28}Si and ^{36}Ar using different types of two-body interactions. Wave functions with good J were determined with the Peierls–Yoccoz method and they were used to calculate energy levels and electric quadrupole transition probabilities within the ground state band. The intrinsic excited states were calculated with the Random Phase Approximation. From comparison with the available experimental data, one finds that the best results occur for ^{20}Ne and when Kuo's renormalized effective two-body interaction is used. (INIS)

15390 SHELL MODEL LEVEL DENSITIES FOR LIGHT NUCLEI. Ayik, S.; Ginocchio, J. N. (Yale Univ., New Haven, Conn. (USA). Nuclear Structure Lab.). Nucl. Phys., A; 234: No. 1, 13-32(25 Nov 1974).

Shell-model level densities are calculated for many light nuclei by assuming the valence nucleons move in the ($1s_{\frac{1}{2}}$,0d,0$f_{\frac{7}{2}}$) orbits about an inert ^{16}O core and interact via realistic effective two-nucleon interactions. These level densities are compared, near the proton threshold, to those of the Fermi level densities used in the compound heavy-ion reactions. The general conclusion is that the Fermi level densities underestimate the level densities of higher angular momentum states. The shell-model level densities are used to extract ground-state energies and low excitation spectra for light nuclei, and these are compared to empirical values. Predicted yrast lines agree well with recent experimental data on high-angular-momentum states in ^{23}Na and ^{23}Mg. (auth)

15391 ELASTIC NEUTRON TRANSFER IN THE SCATTERING OF Si ISOTOPES. Hildenbrand, K. D.; Bock, R.; Bohlen, H. G.; Braun-Munzinger, P.; Fick, D.; Gelbke, C. K.; Weiss, U.; Weiss, W. (Max-Planck-Institut fuer Kernphysik, Heidelberg (F.R. Germany)). Nucl. Phys., A; 234: No. 1, 167-184(25 Nov 1974).

Angular distributions of the elastic scattering of ^{28}Si on ^{29}Si and ^{30}Si have been measured for incident beam energies at E = 65 and 70 MeV with a time-of-flight spectrometer for heavy ions. At 70 MeV the neutron transfer ^{30}Si(^{28}Si,^{29}Si)^{29}Si was observed in addition to the elastic channel. The pronounced oscillations in the elastic scattering distributions are interpreted as being due to an elastic transfer of neutrons between the colliding nuclei during the scattering process. This assumption is in accordance with some general features of the data and allows for the extraction of spectroscopic factors of the transferred neutrons. (auth)

15392 HEAVY ION ONE- AND TWO-PROTON TRANSFER REACTIONS. Sinclair, D. (Oxford Univ. (UK). Nuclear Physics Lab.). Phys. Lett., B; 53: No. 1, 54-56(11 Nov 1974).

The ^{26}Mg(^{16}O,^{15}N)^{27}Al and ^{26}Mg(^{16}O,^{14}C)^{28}Si reactions have been studied at 128 MeV incident energy. In contrast with studies at lower energy (where strong two-proton transfers were observed), at this energy the agreement between the measured cross sections and DWBA predictions is as good as is found with light-ion reactions. Both reactions exhibit the selectivity expected for direct transfer processes. (auth)

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Refer also to abstracts 13816, 15320, 15323, 15331, 15364, 15368, 15373, 15375, 15376, 15380, 15386, 15424, 15425, 15453, 15459, 15504, and 15508.

15393 (CEA-N-1715) LIFETIME MEASUREMENT USING THE DOPPLER SHIFT ATTENUATION: DISCUSSION AND COMPUTER PROGRAMS. Ronsin, H. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Physique Nucleaire). May 1974. 131p. (In French). Dep. NTIS (US Sales Only) $9.75.

The Doppler shift attenuation method for measuring nuclear lifetimes between 10^{-14} and 10^{-11} s has been primarily used in studies of light nuclei. Experimental difficulties increase for heavier nuclei, the shift being proportional to $\sqrt{A}$. In this report, the main features of the method are developed in detail and possible problems are investigated. The advantages in using heavy-ion reactions are examined, which provide a new range of application of the method. The effects of various experimental procedures on the accuracy of results are analysed; in each case (coincidence or singles experiment, thick self-supporting targets or targets evaporated on backing, different set-up geometries), approximations and errors involved are discussed. Lifetimes can be derived from the measurements with the aid of the FORTRAN IV computer codes provided. Both programs work for every experimental condition (e.g. heavy-ion-induced reactions) and include effects of the target thickness; DELMAX calculates the average maximum Doppler shift and the associated error. Energy losses in the target and detector solid angle effects are taken in account. Values of the attenuation factor $F(\tau)$ can be obtained from the Fτ program, which also provides a graph versus (τ). Two approaches to the description of the stopping power were used, and the final results are compared: the theoretical derivation of Lindhard et al., together with the scattering calculation of Blaugrund, and the phenomenological representation of Warburton et al. The separate influence of the nuclear and the electronic part of the slowing process is also studied. (auth)

15394 (COO-535-710, pp 34-35) WEAK ABSORPTION EFFECTS IN THE ^{48}Ca(^{16}O,^{15}N)^{49}Sc REACTION. Schneider, M. J.; Maher, J. V.; Lewis, T. J.; Peng, J. C.; Cheng, C. M.; Song, H. S. 1 Nov 1974.

In technical progress report, November 1, 1973–November 1, 1974.

15395 (COO-535-710, pp 41-44) TWO-STEP PROCESSES IN THE (^{3}He,t) REACTION TO THE ANALOG AND ANTI-ANALOG STATES OF ^{56}Co. Rickertsen, L. D.; Schneider, M. J.; Rudolph, H.; Kraushaar, J. J.; Zimmerman, W. R. 1 Nov 1974.

In technical progress report, November 1, 1973–November 1, 1974.

15396 (COO-535-710, pp 54-56) ENERGY DEPENDENCE OF THE α-PARTICLE OPTICAL POTENTIAL FOR ^{40}Ca AND ^{58}Ni. Chang, H. H.; Ridley, B. W. 1 Nov 1974.

In technical progress report, November 1, 1973–November 1, 1974.

15397 (COO-535-710, pp 129-133) NUCLIDES PRODUCED FROM 18 MeV PROTON BOMBARDMENT OF HAVAR FOIL. Fritts, M. J. 1 Nov 1974.

In technical progress report, November 1, 1973–November 1, 1974.

15398 (INS–764) REPORT ON THE WORK OF THE INSTITUTE OF NUCLEAR SCIENCES. Progress Report 22, July–December 1973. Rafter, T. A. (Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Inst. of Nuclear Sciences). Apr 1974. 136p. Dep. NTIS (US Sales Only) $10.00.

Work in progress during the half-year July-December 1973 is reported. The following subject areas are included: nuclear physics; radiation research; isotope geochemistry-stable isotopes; radioisotope dating and fallout; radioisotope applications; instrumentation; and theoretical physics. Five sections were title listed separately. (LK)

For title listings of selected sections see: 13630, 13709, 13710, 14072, and 15399.

15399 (INS–764, pp 17-18) ^{50}Ti(p,γ)^{51}V. McCallum, G. J.; Pohl, K. P. Apr 1974.

15400 (KIYAI-74-17) SYSTEMATICS OF THE NEUTRON LEVEL DENSITIES IN THE A = 130 TO 200. Pshenichnyi, V. A. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1974. 8p. (In Russian). INIS.

The experimental level densities during interaction of slow neutrons with nuclei in the region from A = 130 to 200 were compared with those calculated on the basis of the independent particle model with consideration of the coupling effects of superconducting types at temperatures above the phase transition point. Such an approach describes satisfactorily a considerable part of the data in the region examined. (tr-auth)

15401 PARTICLE-HOLE MULTIPLETS IN ^{40}Ca OBSERVED IN THE ^{41}Ca(τ,α) REACTION. Cline, D.; de Voigt, M. J. A. (Rochester Univ., N. Y. (USA). Nuclear Structure Research Lab.); Vold, P. B. (Bergen Univ. (Norway). Dept. of Physics); Hansen, O.; Nathan, O.; Sinclair, D. (Niels Bohr Institutet, Copenhagen (Denmark)). Nucl. Phys., A; 233: No. 1, 91-104(11 Nov 1974).

Energy levels in ^{40}Ca up to 10.2 MeV were studied in the neutron pickup reaction ^{41}Ca(τ,α)^{40}Ca with 20 MeV bombarding energy. Thirty excited states were identified and angular distributions were measured in the interval from 5 to 40° by means of a split-pole magnetic spectrometer. The angular distributions together with DW calculations were used to extract l_n values and spectroscopic factors. The $l_n = 2$ strength distribution for the $f_{\frac{1}{2}}d_{\frac{3}{2}}^{-1}$ particle-hole levels is compared to the $l_p = 3$ strength distribution from proton stripping data. (auth)

15402 THE LEVEL STRUCTURE OF ^{50}V AND THE 5.255 MeV ISOBARIC ANALOG RESONANCE IN ^{51}V STUDIED BY ^{50}Ti (p,n) AND (p,nγ) REACTIONS. Tomita, Y.; Tanaka, S. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Nucl. Phys., A; 232: No. 2, 417-435(4 Nov 1974).

The ^{50}Ti(p,n) and (p,nγ) reactions have been studied at proton energies between 3.8 and 5.4 MeV. Excitation functions and angular distributions have been measured for both neutrons and γ-rays. The results have been analyzed by statistical theories. For most of the levels in ^{50}V below 1.9 MeV, spins have been determined. The branching ratios and the mixing ratios for the γ-rays deexciting these levels have also been obtained. The 5.255 MeV analog resonance has been observed in the (p,n) reaction and has been assigned to be $\frac{9}{2}^+$. (auth)

15403 METHOD OF ANALYSIS OF CONVERSION SPECTRA IN THE STUDY OF ATOMIC ENVIRONMENT. Fujioka, M. (Tohoku Univ., Sendai (Japan). Dept. of Physics); Shinohara, T. (Tohoku Univ., Sendai (Japan). Research Inst. for Iron, Steel and Other Metals). Nucl. Instrum. Methods; 120: No. 3, 547-549(15 Sep 1974).

Combination of a rule of constant tail-fraction with a deconvolution method is useful in the analysis of outer-shell conversion spectra in an application of internal conversion to the study of atomic environment. (auth)

15404 THE DEUTERON D-STATE AND EXACT FINITE-RANGE DWBA CALCULATIONS FOR ^{52}Cr(d(pol),p)^{53}Cr. Delic, G.; Robson, B. A. (Technische Univ. Darmstadt (F. R. Germany). Inst. fuer Kernphysik). Nucl. Phys., A; 232: No. 2, 493-501(4 Nov 1974).

The effect of the deuteron D-state in the DWBA approach was investigated for seven transitions in the reaction ^{52}Cr(d,p)^{53}Cr at 10 MeV bombarding energy employing an exact finite-range method with a realistic neutron-proton potential and the corresponding deuteron wave function of Reid. Inclusion of the D-state gives a much better description of the tensor analyzing power data. (auth)

15405 NEUTRON, PROTON, AND α-PARTICLE EMISSION FROM ^{3}He INDUCED REACTIONS. Chevarier, A.; Chevarier, N.; Demeyer, A. (Lyon-1 Univ., 69 – Villeurbanne (France). Inst. de Physique Nucleaire); Alevra, A.; Dumitrescu, R.; Lukas, I. R.; Magda, M. T.; Nistor, M. E. (Institutul de Fizica Atomica, Bucharest (Romania)). Nucl. Phys., A; 231: No. 1, 64-76(7 Oct 1974).

A study of the three most important outgoing reaction channels was undertaken in order to see if pre-equilibrium models can simultaneously explain spectra of different particles emitted in the same reaction. Measurements of energy and angular distributions of neutrons, protons and α-particles emitted from ^{3}He induced reactions on ^{57}Fe, ^{61}Ni, ^{62}Ni and ^{63}Cu at an incident energy of 25.6 MeV were performed. The hybrid model succeeds in giving an overall description of particle spectra, when initial configurations of four excitons are involved in the case of nucleon emission. Besides the evaporative and pre-equilibrium processes, a contribution due to the break-up of the incident particle has also to be taken into account in the case of proton spectra. (auth)

15406 THE RADIATIVE CAPTURE REACTIONS ^{40}Ca(α,γ)^{44}Ti AND ^{48}Ca(α,γ)^{52}Ti IN THE REGION OF THE GIANT DIPOLE RESONANCE. Peschel, R. E.; Long, J. M.; Shay, H. D.; Bromley, D. A. (Yale Univ., New Haven, Conn. (USA). Nuclear Structure Lab.). Nucl. Phys., A; 232: No. 2, 269-286(4 Nov 1974).

An investigation of the reactions ^{40}Ca(α,γ)^{44}Ti and ^{48}Ca(α,γ)^{52}Ti in the region of the giant dipole resonance (GDR) was completed. For the ^{40}Ca(α,γ) reaction, 90° excitation functions over the bombarding energy range 6.5 to 17.5 MeV were obtained for γ-transitions to the ground state and first excited state in ^{44}Ti and for a sum of the unresolved transitions to the third and fourth excited states in ^{44}Ti. Angular distributions were measured at the extrema of the excitation functions. These data suggest that the ^{40}Ca(α,γ) reaction proceeds predominantly via an isospin forbidden E1 transition and populates the T = 1, GDR states of ^{44}Ti via T = 0 isospin impurities. The results provide an estimate of the isospin mixing in the GDR as well as support for a possible giant quadrupole resonance somewhat lower in excitation energy in ^{44}Ti. The excitation functions exhibit a gross structure which reflects the isospin mixing in the GDR of ^{44}Ti, and a structure of intermediate width which may reflect T = 0 α-cluster states in ^{44}Ti. The ^{48}Ca(α,γ$_0$) differential cross section was investigated at 90° over the bombarding energy range 6.0 to 14.0 MeV. The cross section for the isospin allowed ^{48}Ca(α,γ$_0$) reaction was found to be a factor of 20 smaller than that for the isospin forbidden ^{40}Ca(α,γ$_0$) reaction. (auth)

15407 RADIATIVE CAPTURE OF FAST NEUTRONS BY ^{40}Ca. Bergqvist, I.; Drake, D. M.; McDaniels, D. K. (Los Alamos Scientific Lab., N. Mex. (USA)). Nucl. Phys., A; 231: No. 1, 29-44(7 Oct 1974).

The radiative capture cross section for the reaction ^{40}Ca(n,γ)^{41}Ca was measured for the neutron energy range of 6.8 to 18.2 MeV. A NaI(Tl) anti-Compton spectrometer, a pulsed neutron beam, and time-of-flight techniques were utilized. The γ-ray spectra show strong transitions to the $1f_{\frac{7}{2}}$ ground state and a relatively high intensity of unresolved γ-rays to a group of levels at about 2 MeV, where two $\frac{3}{2}^-$ states are known to carry the $2p_{\frac{3}{2}}$ strength, and to levels around 4 MeV, which is the centroid energy of the $2p_{\frac{1}{2}}$ strength. Absolute cross sections were determined for these γ-ray transitions as well as the integrated cross section for transitions to bound states of ^{41}Ca. Only the cross section for the transition to the $f_{\frac{7}{2}}$ ground state of ^{41}Ca shows the resonance behavior predicted by the semidirect (collective) capture theory, but the agreement between the theoretical and measured $f_{\frac{7}{2}}$ cross sections is not satisfactory. The measured cross sections for the other γ-ray peaks are almost constant with neutron energy below about 15 MeV, in sharp contrast to the cross sections predicted by the semidirect theory for $p_{\frac{3}{2}}$ and $p_{\frac{1}{2}}$ transitions. (auth)

15408 COUPLED-CHANNEL ANALYSIS OF PROTON INELASTIC SCATTERING BY ^{48}Ti. Lutz, H. F.; Heikkinen, D. W.; Bartolini, W.; Proctor, I. D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Nucl. Phys., A; 231: No. 3, 365-375 (21 Oct 1974).

Proton elastic and inelastic scattering to the first four excited states of ^{48}Ti has been measured at bombarding energies of 16.5, 18, 20, 22, and 24 MeV. These data have been analyzed by using a coupled-channel calculation with a vibrational phonon model. The optical-model parameters were chosen to vary smoothly with bombarding energy, and the deformation parameters were chosen to be independent of bombarding energy. It was found that the amount of one-phonon states admixed in the two-phonon states is considerable. (auth)

15409 CALCULATED ^{58}Ni REACTION CROSS SECTIONS AROUND 14-MeV NEUTRON ENERGY. Wadhwa, B. S.; Mohindra, R. K. (Kurukshetra Univ., India). Nucl. Sci. Eng.; 56: No. 1, 96-98(Jan 1975).

Cross sections of ^{58}Ni for interactions of the type (n,p), (n,n'), (n,α), (n,n'p), (n,2n), (n,n'α), (n,αn'), (n,αp), (n,pn'), and (n,2p) with neutrons of 14.8 and 14.0 MeV (laboratory system) were computed by using a diffused-edge optical-model potential. The spin dependence, shell, and pairing energy effects in the various level-density formulas were considered. The compound-nucleus and the direct-interaction contributions were calculated separately. The computed cross sections are quite suitable for direct comparison with experimental values obtained from activation techniques and energy and angular distributions. The shell-dependent Newton's level-density formula gives better agreement for primary and secondary emission. (1 table) (auth)

15410 LEVEL STRUCTURE OF ^{47}V FROM THE ^{47}Ti(p,nγ)^{47}V REACTION. Schulz, N.; Toulemonde, M. (Centre National de la Recherche Scientifique, 67 – Strasbourg (France). Lab. de Physique du Noyau et de Physique des Particules). Nucl. Phys., A; 230: No. 3, 401-412(30 Sep 1974).

Measurements of level positions and decay modes in ^{47}V were carried out using the ^{47}Ti(p,nγ)^{47}V reaction. Spin and mixing ratio assignments are made for levels below 1.8 MeV excitation using a statistical compound nuclear calculation. The level structure of ^{47}V is compared with recent theoretical predictions. (auth)

15411 ELASTIC AND INELASTIC SCATTERING OF 15 MeV POLARIZED DEUTERONS FROM Ti, Cr, Fe AND Ni ISOTOPES. Baker, F. T.; Davis, S.; Glashausser, C.; Robbins, A. B. (Rutgers – the State Univ., New Brunswick, N. J. (USA)). Nucl. Phys., A; 233: No. 2, 409-424(18 Nov 1974).

The elastic and inelastic scattering of 15 MeV polarized deuterons from ^{48}Ti, ^{50}Ti, ^{52}Cr, ^{54}Fe, ^{56}Fe, ^{58}Ni, ^{60}Ni, ^{62}Ni and ^{64}Ni has been investigated. Angular distributions of the cross section and vector analyzing power iT_{11} have been measured for most of these nuclei. The tensor analyzing powers T_{20} and T_{22} have been studied for ^{54}Fe, ^{56}Fe, and ^{62}Ni in both elastic and inelastic scattering; T_{21} has been measured for ^{54}Fe and ^{56}Fe. Cross sections and vector analyzing powers are reasonably well explained

by the optical model for elastic scattering and by the DWBA with a macroscopic form factor for the inelastic scattering. Anomalous behavior of the N = 28 nuclei found in the inelastic scattering of polarized protons is not present for deuterons. The effect of a distorted spin–orbit term is negligible. Tensor analyzing powers for both elastic and inelastic scattering are poorly fitted with standard procedures; the introduction of a T_R tensor potential does not improve the predictions. (auth)

15412 PROTON OCCUPATION NUMBERS FOR ^{44}Ca. Dehnhard, D.; Cage, M. E. (Minnesota Univ., Minneapolis (USA). John H. Williams Lab. of Nuclear Physics). Nucl. Phys., A; 230: No. 3, 393-400(30 Sep 1974).

The (d, ^{3}He) proton pickup reaction on ^{44}Ca has been studied at a deuteron energy of E_d = 19.0 MeV using the Minnesota MP Tandem Van de Graaff. Differential cross sections were measured at forward angles, and spectroscopic factors were extracted in the usual fashion for the transitions to five states of ^{43}K. The results are compared with previous proton pickup and stripping reactions on the even Ca isotopes. Only about half of the sd hole state excitation strength observed in the stripping reactions could be found in the pickup from the fp orbitals if the data are analyzed by standard distorted wave calculations. This discrepancy can be removed by using bound state potential radii which are slightly larger for sd orbitals than for fp orbitals. (auth)

15413 GAMMA-RAY TRANSITIONS IN ^{38}K. Collins, C. S. C. Notre Dame, IN; Univ. of Notre Dame (1974). 115p. University Microfilms Order No. 74-26,421.

Thesis (Ph. D.).

A study of the odd-odd self-conjugate nucleus ^{38}K through the measurement of γ-ray transition energies and angular correlations is presented. Excited states of ^{38}K were produced with the ^{40}Ca(d,α) reaction at a deuteron beam energy of 8.00 MeV and with the reaction ^{36}Ar(^{3}He,p) at 8.34 MeV. A series of γ-ray measurements were made all in coincidence with particles detected near 180°. A p-γ angular correlation measurement was done with the latter reaction, using a 40 cm^3 Ge(Li) detector. Energies were measured for 48 γ-ray transitions connecting 37 levels in ^{38}K. For these levels, excitation energies and branching ratios are presented. While this work significantly extends knowledge of the γ-decay of excited states in ^{38}K, for many of the levels seen in spectrograph work in the region above 4.40 MeV, no γ-decay was identified. Branching ratios were determined from the angular correlations, and multipole mixing ratios, though often with large uncertainties, obtained. By using these values and reported lifetime measurements transition strengths were calculated. From these transition strengths and the results of the angular correlations, $J^\pi = 1^+$ assignment could be made to the 3340 keV level. In addition, limits could be placed for the spin-parity of five more states: 3614 keV, J = 3,5; 3685 keV, $J^\pi = 3,5^-$; 3855 keV, J = 1,2; 3975 keV, J = 1,2; 4213 kev: J = 1,2. On the basis of this work a J^π, T = (0^+,1) assignment is suggested for the 3698 keV level. Also, reduced transition probabilities B(M1) ↓ and B(E2) ↓ of the 3428 keV level were calculated, and, assuming it to be the lowest J^π, T = 2^+,0 state in ^{38}K, these were compared with the available theoretical values. (Diss. Abstr. Int., B)

15414 ^{52}Mn LEVEL INVESTIGATION FROM THE (α,d) REACTION WITH ^{50}Cr. Gaillard, P. (Univ., Lyon); Guichard, A.; Grossiord, J. Y.; Gusakow, M.; Pizzi, J. R.; Bagieu, G.; Cole, A. J.; de Swiniarski, R. J. Phys. (Paris); 35: No. 4, 329-334(Apr 1974). (In French).

The reaction ^{50}Cr(α,d)^{52}Mn was studied at 31.2 MeV. Angular distributions of some of the observed levels were obtained. Glendenning's theory was applied for the analysis of the experimental results. (auth)

15415 DISCRETE AMBIGUITY IN THE EXPERIMENTAL ^{40}Ca CHARGE DENSITY. Sick, I. (Basel Univ. (Switzerland). Physikalisches Inst.). Phys. Lett., B; 53: No. 1, 15-17(11 Nov 1974).

Elastic electron scattering and muonic X-ray data are used to determine the ^{40}Ca charge density in a model-independent manner. A discrete ambiguity of ρ(r) at small radii is discovered. An analysis of ^{39}K and ^{48}Ca data does not allow removal of this ambiguity. (auth)

15416 HIGH-RESOLUTION MEASUREMENTS OF BETA-DELAYED PROTONS FROM ^{37}Ca AND ^{41}Ti. Sextro, R. G.; Gough, R. A.; Cerny, J. (California Univ., Berkeley (USA). Dept. of Chemistry), Nucl. Phys., A; 234: No. 1, 130-156 (25 Nov 1974).

Protons with energies from 870 keV to 5.4 MeV have been observed following bombardment of a ^{40}Ca target with ^{3}He at beam energies of 29.5, 36.5 and 60 MeV, as well as from 40-MeV ^{3}He bombardment of an ^{36}Ar gas target. These data, and those resulting from 20-MeV proton bombardment of ^{40}Ca, permit accurate identification of proton unbound levels in ^{41}Sc, ^{37}K, and ^{40}Ca fed by allowed beta decay from ^{41}Ti, ^{37}Ca and ^{40}Sc, respectively. Absolute ft values have been determined for beta decay to these levels. The half-life to ^{41}Ti has been remeasured to be 80 ± 2 ms, and the log-ft for its superallowed decay branch has been found to be 3.35 ± 0.02, indicating an isospin purity for the lowest T = 3/2 state in ^{41}Sc of ~91%. The ft values for ^{37}Ca β^+ decay are compared to shell-model calculations for beta decay in A = 37 nuclei. (auth)

15417 IDENTIFICATION OF THE MISSING $3/2^-$ STATE IN ^{41}Ca. Seth, K. K.; Iversen, S. G. (Northwestern Univ., Evanston, Ill. (USA)). Phys. Lett., B; 53: No. 2, 171-173(25 Nov 1974).

In a high resolution ^{40}Ca(d,p)^{41}Ca experiment a new l = 1 transition was unambiguously identified as a state at 3730 keV in ^{41}Ca. Arguments are presented to show that this state has $J^\pi = 3/2^-$ and that it corresponds to the third $3/2^-$ state predicted by Gerace and Green in their coexistence model calculations. (auth)

15418 HARTREE-FOCK-BOGOLYUBOV PROJECTED SPECTRA FOR Cr AND Fe ISOTOPES AND THE EFFECTIVE INTERACTIONS IN THE 2p-1f SHELL. Sharma, S. K. (International Centre for Theoretical Physics, Trieste (Italy)). Phys. Lett., B; 53: No. 2, 155-157(25 Nov 1974).

The intrinsic states of Cr and Fe isotopes are obtained by carrying out deformed Hartree-Fock-Bogolyubov calculations employing the Kuo-Brown effective interaction for the 2p-1f shell modified slightly to satisfy the restrictions imposed on it by the B(E2)(O → 2) systematics in the shell. The angular momentum projected spectra resulting from the modified interaction are in good agreement with the experimental results. (auth)

15419 SIMPLE TWO-LEVEL MODEL OF THE HOLE-VIBRATION QUADRUPLET IN ^{39}K. Hamamoto, I. (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)); Osnes, E. (Oslo Univ. (Norway). Fysisk Institutt). Phys. Lett., B; 53: No. 2, 129-132(25 Nov 1974).

The $3/2^-$(3.02), $1/2^-$(3.88), $1/2^-$(2.82, 4.13) and $9/2^-$(3.60 MeV) levels in ^{39}K are described in a simple two-level model consisting of a $d_{\frac{3}{2}}^{-1}$ proton hole coupled to the 3^- vibration in ^{40}Ca and the dominating two-hole, one-particle shell-model configuration. Reasonable agreement with experimental energies and electric octupole transition strengths is obtained. (auth)

15420 SHELL EFFECTS IN COLLECTIVE EXCITATIONS AND A SHELL MODEL DESCRIPTION USING A RENORMALIZED EFFECTIVE INTERACTION. Morsch, H. P. (Max-Planck-Institut fuer Kernphysik, Heidelberg (F.R. Germany)). Phys. Lett., B; 53: No. 1, 3-5(11 Nov 1974).

A shell-model description, using a renormalization of the effective interaction due to core polarization, is applied to inelastic ^{3}He scattering to the lowest collective states in the mass region Ar to Cr, where strong shell effects are observed. With a constant renormalization in the whole mass region a pure valence particle excitation leads to excellent agreement with experimental inelastic excitation strengths and electromagnetic transition probabilities. (auth)

15421 ELASTIC ELECTRON SCATTERING FROM THE M7 MAGNETIZATION DENSITY OF ^{51}V. Nascimento, I. C.; Moreira, J. R.; Goldemberg, J. (Sao Paulo Univ. (Brazil). Instituto de Fisica); Fukuda, S.; Terasawa, T.; Saito, T.; Hosoyama, K.; Torizuka, U. (Tohoku Univ., Sendai (Japan). Lab. of Nuclear Science). Phys. Lett., B; 53: No. 2, 168-170(25 Nov 1974).

Cross sections of the elastic scattering of electrons from ^{51}V were measured at 155° in the q region of 1.2 to 2.4 fm^{-1}. The value of the M7 magnetic moment 505 ± 30$_{\mu N}$ fm^6 and the oscillator parameter b = 1.86 ± 0.04 fm were deduced. (auth)

Nuclear Properties and Reactions, 59 ≤ A ≤ 89

Refer also to abstracts 14144, 15027, 15349, 15380, 15397, 15400, 15405, 15411, 15436, 15442, 15453, and 15523.

15422 (CEA-CONF-2821) OPTICAL MODEL AMBIGUITIES ON ELASTIC SCATTERING AND DIRECT TRANSFER REACTIONS INDUCED BY 56 MeV ^{16}O BEAM ON ^{64}Ni. Lemaire, M. C.; Mermaz, M. C.; Sztark, H.; Cunsolo, A. (CEA Centre d'Etudes

Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 1974. 1p. (CONF-740637-10). Dep. NTIS (US Sales Only) $4.00.

From international conference on reactions between complex nuclei; Nashville, Tennessee, USA (10 Jun 1974).

Angular distributions for the reactions ^{64}Ni(^{16}O, ^{15}O)^{65}Ni, ^{64}Ni(^{16}O, ^{15}N)^{65}Cu, and ^{64}Ni(^{16}O, ^{14}C)^{66}Zn were measured. A phenomenological optical-model potential could be found which simultaneously reproduced the elastic scattering cross sections and the angular distributions of the one- and two-proton-transfer reactions. However, Igo ambiguities remained. The elastic scattering and one-nucleon-transfer angular distributions exhibited the classical shapes of processes dominated by strong absorption phenomena in the presence of a very strong Coulomb field; in contrast, oscillations appeared at forward angles in the two-proton-transfer reaction. Fits are shown, and the optical potential is tabulated. (1 figure, 1 table) (RWR)

15423 (COO-535-710, pp 31-33) ^{87,85}Rb(^{3}He,d)^{88,86}Sr. Brabeck, P. G.; Schneider, M. J.; Anderson, R. E. 1 Nov 1974.

In technical progress report, November 1, 1973–November 1, 1974.

15424 (COO-535-710, pp 81-86) STUDIES ON EVEN NUCLEI IN THE f,p SHELL. Fielding, H. W.; Anderson, R. E.; Edwards, F. M.; Lind, D. A.; Zafiratos, C. D. 1 Nov 1974.

In technical progress report, November 1, 1973–November 1, 1974.

15425 (COO-535-710, pp 93-95) THICK TARGET MEASUREMENT OF STELLAR AND THERMONUCLEAR REACTION RATES. Roughton, N. A.; Fritts, M. J.; Peterson, R. J.; Hansen, C. J.; Zaidins, C. S. 1 Nov 1974.

In technical progress report, November 1, 1973–November 1, 1974.

15426 (IPNO-PhN-73-07) NUCLEAR STUDY OF THE (p,α) REACTION ON ^{93}Nb AND ^{89}Y. Vergnes, M.; Rotbard, G.; Kalifa, J.; Berrier-Ronsin, G. (Paris-11 Univ., 91–Orsay (France). Inst. de Physique Nucleaire). 1973. 24p. INIS.

The (p,α) reaction was studied at 15.2 MeV on ^{93}Nb and ^{89}Y and analyzed using DWBA and cluster form factors. The reaction is a direct triton pickup and the compound nucleus is negligible. In the first case the transferred neutrons are the two extra N = 50 shell neutrons and the reactions behave like a proton pickup. Several positive parity states of ^{90}Zr are populated by $g_{9/2}$ transfers with strengths in good agreement with a simple model; new levels are excited corresponding to $p_{3/2}$ and $f_{5/2}$ proton holes. In the second case the two neutrons are picked in the filled N = 50 shell; states corresponding to proton and neutron configurations in ^{88}Sr are excited with comparable strengths, and it is more difficult to get unambiguous spectroscopic information. The shapes of the angular distributions are well reproduced however, and tentative spins and parities can be proposed for several states. (auth)

15427 (KFK-EXT-3/74-6) MEASUREMENT OF THE $\beta\gamma$ CIRCULAR POLARIZATION CORRELATION FOR DETERMINING THE NUCLEAR STRUCTURE OF ^{86}Rb AND ^{86}Sr. Buerk, K. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Experimentelle Kernphysik). Oct 1974. 70p. (In German). Dep. NTIS (US Sales Only) $6.50.

Thesis. Submitted to Karlsruhe Univ. (TH) (F. R. Germany). Fakultaet fuer Physik.

The cascade ^{86}Rb(2$^-$) $\xrightarrow{\beta^-}$ ^{86}Sr(2$^+$) $\xrightarrow{\gamma}$ ^{86}Sr(0$^+$) was used to measure the beta-gamma circular polarization correlation. For this purpose, a multi-detector device was developed allowing simultaneous measurement at four different angles. In order to achieve detection of a defined energy range of the beta spectrum, four sector-field magnetic spectrometers were applied. Measurement of the circular polarization of the gamma radiation was done by Compton forward scattering from magnetized iron. The two polarimeters used for these measurements have been adjusted so as to optimally meet the energetic and geometric requirements. A comparison of the measured data with given computations yields information on the structure of the nuclear states involved. Results of measurements of further quantities observed previously were also included in the comparative evaluation. In spite of the almost semimagic nuclear configuration in ^{86}Rb, an interpretation within the framework of the simple shell model is found to be impossible. However, the measured results can be well interpreted in accordance with the "weak coupling" model by coupling of vibrational states. (auth)

15428 (UCRL-76207) RECENT DEVELOPMENTS IN THE DESCRIPTION OF ODD-MASS NUCLEI. Meyer, R. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 4 Nov 1974. 115p. (CONF-741131-3). Dep. NTIS $8.75.

From international conference on gamma-ray transition probabilities; Delhi, India (11 Nov 1974).

A detailed survey of the medium-mass region (60 < A < 140) of the nuclear chart was made to compare a number of recent theoretical calculations with the significant body of experimental information coming into the published literature. A comparison of the level properties of the Z = 51 antimony nuclei shows a very good agreement with the recent calculations of Vanden Berghe, who includes two-particle one-hole configurations. The level structure and electromagnetic properties of the Z or N = 53 nuclei are not predicted so well as the antimony nuclei. Inclusion of three-particle clustering has improved the agreement between calculated and experimental electromagnetic transition rates for the low lying levels in odd-mass nuclei. More recent calculations using a dressed quasi-particle formalism are shown to have some success. The detailed experimental study of odd-mass iodine near the neutron shell closure at N = 82 suggests that the particle-core interaction can account for a majority of the levels observed, if one uses an even-even core that includes known low lying two-proton states. The nonnormal parity states in a given shell have higher J values than the normal parity states (e.g., $h_{11/2}$ in the g-d-s shell). This can cause significant deviations from the expected vibrational character. Studies of the odd-mass Z= 57 lanthanum nuclei suggest that the Coriolis force and its effect on high J state coupling to the core can be used to account for the excess negative-parity states observed in the lanthanum nuclei and their electromagnetic decay properties. The deformability of the cadmium (Z = 48) core and the Coriolis force may be the causes of apparent rotationlike level structure observed in the experimental studies of the odd-mass indium nuclei. These results suggest that more attention should be paid to the inclusion of a dynamic rather than static core and that the Coriolis force should be included as part of any complete, effective interaction. (auth)

15429 HIGH RESOLUTION STUDY OF THE $g_{9/2}$ ISOBARIC ANALOG STATE IN ^{61}Cu. Adachi, M. (Tokyo Inst. of Tech.); Hattori, T.; Arai, E.; Ogawa, M.; Satoh, H. J. Phys. Soc. Jap.; 36: No. 5, 1266-1272(May 1974).

The $g_{9/2}$ isobaric analog state (IAS) in ^{61}Cu has been investigated by the ^{60}Ni(p,p)^{60}Ni and (p,γ)^{61}Cu reactions using high energy-resolution (overall $\Delta E \simeq 350$ eV) proton beams. Resonances at E_p (lab) = 3723, 3732, 3737 and 3743 keV are identified as fragments of the IAS of the $g_{9/2}$ state in ^{61}Ni. Proton widths and radiative widths of these isobaric analog resonances (IAR's) are deduced using a multi-level R-matrix code. Gamma-ray spectra and γ-ray angular distributions from these IAR's have been measured with a Ge(Li) detector. Primary γ-ray branching ratios are presented. The IAS to anti-IAS (AIAS) M1 transition strength is deduced to be 0.36 ± 0.08 W. U. and is compared with a simple shell model prediction. (auth)

15430 A LOW-SPIN ISOMER IN ^{74}Br; ITS HALF-LIFE AND DECAY SCHEME. Schmeing, H.; Graham, R. L.; Hardy, J. C.; Geiger, J. S. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Nucl. Phys., A; 233: No. 1, 63-72(11 Nov 1974).

The isotope ^{74}Br was produced as the daughter of ^{74}Kr. This production mode leads to a ^{74}Br isomer whose half-life was measured to be 25.3 ± 0.3 min. A decay scheme based on the 85 observed β-delayed γ-rays suggests the spin assignment $(0,1)^-$. Previous detailed studies have reported a 41.5 ± 1.5 min, 4^- isomer of ^{74}Br which is produced directly in nuclear reactions. There is no indication which of the two isomers represents the ground state of ^{74}Br. (auth)

15431 ELECTROMAGNETIC DECAY OF A FRAGMENTED ANALOGUE STATE IN ^{63}Cu. Wimpey, J. F.; Mitchell, G. E.; Bilpuch, E. G. (Triangle Universities Nuclear Lab., Durham, N. C. (USA)). Nucl. Phys., A; 233: No. 1, 9-19(11 Nov 1974).

The ^{62}Ni(p,p) (p,p'γ) and (p,γ) reactions were studied in the vicinity of the $^5/_2^-$ fragmented analogue of the first excited state of ^{63}Ni. The overall proton energy resolution was about 300 eV. The γ-rays were detected with both NaI (Tl) and Ge(Li) detectors. Elastic and inelastic proton widths and partial and total γ-ray widths were measured for each of the fourteen fine structure states of the analogue. Statistically significant correlations were observed between the elastic proton widths, the inelastic proton widths and the total γ-ray widths. (auth)

15432 AN EXPERIMENTAL STUDY OF NEUTRON ELASTIC SCATTERING AT FORWARD ANGLES. Corcalciuc, V.; Holmqvist, B.; Wiedling, T. (Aktiebolaget Atomenergi, Studsvik (Sweden)). Nucl. Phys., A; 232: No. 2, 436-444(4 Nov 1974).

Measurements of fast neutron scattering cross sections in the extreme forward and backward angular ranges always involve

experimental difficulties. These are serious in particular at forward angles where the angular change of the differential cross section is very large in the fast neutron energy range. Furthermore this effect also increases with the mass number of the elements. Thus accurate analytical, i.e., Legendre polynomial, descriptions of experimental angular distributions of elastically scattered neutrons demand carefully performed differential cross section measurements with special regard to density and distribution of measured points. Accordingly the geometry of the neutron target-scattering sample-detector arrangements must be optimized with respect to detector position and neutron background. With these points of view in mind measurements were performed at angles between 10 and 40° at 7 MeV neutron energy on samples of Fe, Co, Ni, Pb and Bi. The energy and elements chosen are representative for an investigation of the differential elastic scattering functions for which the cross section change is large at forward angles. The present data were compared with previous Studsvik measurements made at angles greater than 20°, extrapolated to smaller angles. Good agreement was obtained between the new data points and distributions obtained by Legendre polynomial fitting to previous "large" angle data. This result also means that the differential cross section measurements of previous reports can be used for extrapolation to small angles by means of the given Legendre polynomial expansions. (auth)

15433 MEASURED THERMAL-NEUTRON CROSS SECTION FOR THE $^{59}Ni(n,\alpha)^{56}Fe$ REACTION. Werner, R. D.; Santry, D. C. (Chalk River Nuclear Labs., Ont.). Nucl. Sci. Eng.; 56: No. 1, 98-100(Jan 1975).

Deviations from normal mechanical properties observed in stainless steel irradiated by neutrons have been attributed to the production of helium in neutron reactions with nickel. A measurement of the thermal-neutron cross section for the $^{59}Ni(n,\alpha)^{56}Fe$ reaction was made in which the alpha-particle emission was determined by a silicon surface-barrier particle spectrometer. The 2200-m/s cross section obtained is 18.0 ± 1.6 b. This value disagrees with 13.7 ± 0.6 b reported earlier by Eiland and Kirouac. (4 figures) (auth)

15434 ISOBARIC ANALOGUE RESONANCES IN PROTON ELASTIC SCATTERING FROM ^{84}Sr. van Eeghem, W. P.Th.M.; Meurders, F.; Spilling, P.; Witteveen, G. J. (Technische Hogeschool Eindhoven (Netherlands)). Nucl. Phys., A; 233: No. 2, 425-434(18 Nov 1974).

The cross section for the reaction $^{84}Sr(p,p_0)^{84}Sr$ has been measured for proton energies in the range E_p = 4.18-6.73 MeV. Resonance parameters were determined for 15 isobaric analogue resonances. Spectroscopic factors calculated for the analogues by means of the R-matrix theory and the Green function method are compared with spectroscopic factors determined from the $^{84}Sr(d,p)^{85}Sr$ reaction. Angular distributions were measured at E_p = 7 and 12 MeV in order to obtain optical model parameters. (auth)

15435 STUDY ON THE COINCIDENCES OF γ-QUANTA EMITTED IN THE COULOMB EXCITATION OF ^{61}Ni AND ^{73}Ge. Andreev, D. S.; Lemberg, I. Kh.; Petrov, S. A.; Rev'yuk, K. K.; Chugunov, I. N. (AN SSSR, Leningrad. Fiziko-Tekhnicheskij Inst.). Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 721-724 (Apr 1974). (In Russian).

From 24th annual conference on nuclear spectroscopy and nuclear structure; Kharkov, USSR (29 Jan 1974). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

The γ coincidences registered with a NaI(Tl) scintillation detector with the γ quanta registered by a coaxial Ge(Li) detector were measured. Transition schemes for ^{61}Ni and ^{73}Ge were made more precise. (tr-auth)

15436 THE MAGNETIC MOMENT OF THE $9/2^+$ STATE IN ^{85}Rb, MESONIC CONTRIBUTIONS IN THE Z = 37 REGION AND BLOCKING OF CORE POLARIZATION IN THE $1f_{5/2}$ PROTON SHELL. Heubes, P.; Ingwersen, H.; Johann, H. G.; Klinger, W.; Loeffler, W.; Schatz, G. (Erlangen-Nuernberg Univ., Erlangen (F.R. Germany). Physikalisches Inst.). Nucl. Phys., A; 234: No. 1, 81-93(25 Nov 1974).

The g factor of the $9/2^+$ state in ^{85}Rb (E = 513 keV; $T_{1/2}$ = 1015 ns) was measured by the TDPAD and the SOPAD methods. The experimental value corrected for diamagnetism and the Knight shift is g = +1.369 ± 0.010. The analysis of this g factor together with the g factors of the ground states in $^{85,87}Rb$ shows that the effects usually attributed to mesonic exchange currents depend rather strongly on the corrections for core polarization. A comparison of g factors of $9/2^+$ states in As, Br and Rb isotopes shows a linear increase of the magnetic moments with increasing number of nucleons in the $1f_{5/2}$ proton shell as predicted by the M1 core polarization theory. (auth)

Nuclear Properties and Reactions, 90 ≤ A ≤ 149

Refer also to abstracts 13846, 14799, 15296, 15320, 15331, 15364, 15380, 15400, 15425, 15426, 15428, 15461, 15465, 15466, 15520, 15538, and 15541.

15437 (CONF-740992-2) SIMILARITIES BETWEEN THE Sm AND Cd, EVEN-Z, EVEN-N NUCLEI AND THE SYSTEMATICS OF THE LEVEL SCHEMES OF THE INTERVENING NUCLEI. Smither, R. K. (Argonne National Lab., Ill. (USA)). 1974. 15p. Dep. NTIS $4.00.

From conference on vibrational nuclei; Zagreb, Yugoslavia (23 Sep 1974).

The similarity between the level schemes of the Sm and Cd nuclei and the smooth transition in the level schemes of the nuclei which separate them are pointed out. The change in the overall character of the ground-state rotational band in even-Z, even-N nuclei is a smooth function of neutron number. Energy levels of Sm, Ce, Xe, Te, and Cd nuclei are discussed. (8 figures) (RWR)

For title listings of individual papers see: 13629, 14182, 14183, 15309, 15321, 15365, 15366, 15394-15397, 15423-15425, 15439-15442, and 15475.

15438 (COO-535-710) TECHNICAL PROGRESS REPORT, NOVEMBER 1, 1973-NOVEMBER 1, 1974. (Colorado Univ., Boulder (USA). Nuclear Physics Lab.). 1 Nov 1974. Contract AT(11-1)-535. 171p. Dep. NTIS $11.75.

Use of the rotating beam spectrometer facility dominated the experimental studies. The neutron time-of-flight facility yielded a wide range of (^{3}He,n) data. Details on the construction and field mapping for EPICS are given. The theoretical program was intimately associated with the experimental work, as in the study of the (p,d)(d,n) contribution to the charge-exchange reaction. The following areas are covered: charged-particle nuclear reactions (including single-nucleon and multi-nucleon transfer reactions and elastic and inelastic scattering), gamma-ray experiments and beta decay, neutron time-of-flight experiments, x-ray fluorescence trace element analysis, intermediate energy physics, apparatus and facility development, the theoretical program, other activities, publications and reports, and personnel. Articles with significant amounts of information are title listed separately. (RWR)

15439 (COO-535-710, pp 6-10) PROTON SPECTROSCOPY OF ^{105}Ag FROM THE (^{3}He,d) REACTION. Anderson, R. E.; Kraushaar, J. J. 1 Nov 1974.

In technical progress report, November 1, 1973-November 1, 1974.

15440 (COO-535-710, pp 10-18) STUDY OF THE $^{106}Pd(p,d)^{105}Pd$ AND $^{108}Pd(^3He,d)^{107}Ag$ REACTIONS. Anderson, R. E.; Bunting, R. L.; Burch, J. D.; Chinn, S. R.; Kraushaar, J. J.; Peterson, R. J.; Prull, D. E.; Ridley, B. W.; Ristinen, R. A. 1 Nov 1974.

In technical progress report, November 1, 1973-November 1, 1974.

15441 (COO-535-710, pp 19-31) LEVEL STRUCTURE OF ^{106}Ag. Anderson, R. E.; Bunting, R. L.; Burch, J. D.; Chinn, S. R.; Kraushaar, J. J.; Peterson, R. J.; Prull, D. E.; Ridley, B. W.; Ristinen, R. A. 1 Nov 1974.

In technical progress report, November 1, 1973-November 1, 1974.

15442 (COO-535-710, pp 73-80) STUDIES OF THE (^{3}He,n) REACTION ON Sn, Cd, Zr, AND Sr, ISOTOPES. Fielding, H. W.; Anderson, R. E.; Lind, D. A.; Zafiratos, C. D.; Alford, W. P. 1 Nov 1974.

In technical progress report, November 1, 1973-November 1, 1974.

15443 (FRNC-TH-472) EXCITATION FUNCTIONS AND MEAN PATHS OF HEAVY NUCLEI PRODUCED IN INTERACTIONS BETWEEN B IONS AND Ta AND Ag TARGETS. Hubert, F. (Bordeaux-1 Univ., 33 (France)). 1973. 168p. (In French). Dep. NTIS (US Sales Only) $11.50.

Thesis.

The characteristics of reactions induced by ^{10}B and ^{11}B ions on tantalum and silver targets were studied for energies in the 10.5 MeV/N region. The cross sections for the formation of heavy products in the target were measured together with the projections of the mean paths along the axis of the beam as a function of the energy of the incident ions. The interactions (compound nucleus and different types of transfer) undergone by each of the radioisotopes detected were defined from the form of the excitation

functions and the variations in mean path with energy. Statistical theory can be used to explain the experimentally measured excitation functions, if the different types of de-excitation are taken into account. Compound nuclei were produced (from boron ions) having maximum angular momenta relatively far from the Yrast levels. The values of $\langle epsilon_N \rangle$ are deduced from the measurements, these values being intermediate between those obtained with light particles and heavier ions. The best agreements between the experimental excitation functions and those calculated from the statistical evaporation model were obtained using a dipolar γ radiation emission rate very similar to that deduced from the γ widths of the neutron capture reactions. (auth)

15444 (INIS-mf-1569) DIRECTIONAL CORRELATIONS OF GAMMA TRANSITIONS IN ^{134}Xe. Gualda, J. M.; Saxena, R. N. (Instituto de Energia Atomica, Sao Paulo (Brazil)). [nd]. 20p. INIS.

The directional correlations of coincident γ-transitions in ^{134}Xe were measured using a Ge(Li)-NaI(Tl) spectrometer. The measurements were carried out for twelve different gamma cascades. Spin assignments were made for various energy levels, and previous spin assignments for others were confirmed. Multipole mixing ratios σ (E2/M1) were obtained for the gamma cascades. (auth)

15445 (LYCEN-7371) STUDY OF THE ELECTROMAGNETIC PROPERTIES AND STRUCTURE OF SOME TRANSITION NUCLEI SITUATED NEAR TO THE 50 AND 82 CLOSED SHELLS. Meyer-Levy, M. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire). Dec 1973. 119p. (In French). Dep. NTIS (US Sales Only) $9.00.

Thesis.

Transition nuclei representing the following three classes of nucleus were studied: odd A nuclei and even-even nuclei situated two or four nucleons from 50 to 82 closed shells. The majority of the measurements made concerned the lifetimes of excited nuclear states from which reduced transition probabilities were obtained; these probabilities are very sensitive to the state configurations and can cause errors of the order of 10^2, or, in extreme cases, 10^3 between experiment and theory. The perturbed angular correlation method and a knowledge of the different lifetimes were used together to determine the values of the magnetic moments of the corresponding nuclear states. Excited state lifetime measurements performed on ^{105}Cd, ^{107}Cd and ^{109}Cd nuclei using the $(\beta\text{-}\gamma)$ and $(\gamma\text{-}\gamma)$ delayed coincidence method led to the determination of large delay factors for neutron forbidden $(M1\ 7/2(1^+) \rightarrow 5/2(1^+))$ $\Delta l = 2$ transitions. The values obtained indicate the core to be highly polarized. At low energies (E < 2 MeV), these odd A transition nuclei present dominant external particle effects. In the case of ^{192}Pt, ^{194}Pt and ^{196}Pt nuclei, the lifetimes of the first excited states and the g factors of the $2(1^+)$ states correspond to a behavior of the $2(2^+)$ states which shows the uniquely collective Kumar-Baranger model to be at fault. The intermediate coupling phenomenological model (even or odd nuclei) was applied to these nuclei together with Hg(Z = 80) isotopes and N = 80 isotones having vibrational substructures. In this way it was shown that the field-particle hypothesis is justified. (auth)

15446 (LYCEN-7379) DECAY OF 3.0 MIN ^{143}Eu AND THE LEVELS OF THE N = 81 ^{143}Sm AND ^{141}Nd NUCLEI. Charvet, A.; Chery, R.; Do Huu Phuoc; Duffait, R. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire). Dec 1973. 11p. Dep. NTIS (US Sales Only) $4.00.

The decay of 3.0 min ^{143}Eu was investigated using a Ge(Li) detector. The β^+ spectrum obtained with a Si(Li) spectrometer leads to a Q-value of 5100 ± 50 keV. For the first time a decay scheme including levels situated at 107.5, 755.0, 1107.9, 1537.5, and 1912.8 keV was established. The data are compared to those obtained for the neighboring N = 81 ^{141}Nd nucleus. Besides, new experimental measurements indicate that the 1345.4 keV level in ^{141}Nd has not the odd-parity and would be $5/2^+$, $7/2^+$. Hence, the $7/2^-$ state is situated at 1967.4 keV. Those data are in reasonable agreement with intermediate coupling calculations. (auth)

15447 (UCRL-50400(Vol. 8)) GRAPHICAL EXPERIMENTAL DATA FOR SUPPLEMENTAL NEUTRON-INDUCED INTERACTIONS. Cullen, D. E.; Haight, R. C.; Howerton, R. J.; MacGregor, M. H.; Perkins, S. T. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 31 Oct 1974. Contract W-7405-eng-48. 831p. Dep. NTIS $19.25.

Volumes 7 and 8 present graphs of all cross sections contained in the Experiment Cross Section Information Library (ECSIL) as of March 1, 1974. Volume 7 consists primarily of interactions where a single data set contains enough points to show cross section behavior. Volume 8 consists of interactions where more than one data set is needed to show cross section behavior. Thus, the total, elastic, capture, and fission cross sections (along with the parameters $\bar{\nu}$, α, and η) are found in Vol. 7. All other reactions are in Vol. 8. For the sake of clarity, the data are plotted without associated error bars. The plots are arranged in ascending order of atomic number (Z) and atomic weight (A). (auth)

15448 NEW GIANT RESONANCES IN NUCLEI. An Interim Review. Satchler, G. R. (Oak Ridge National Lab., Tenn. (USA)). Phys. Rep.; 14: No. 3, 97-127(Nov 1974).

107 refs.

The recent evidence for new giant multipole resonances in nuclei is reviewed, particularly for a supposedly isoscalar quadrupole resonance with an excitation energy of about 60 to $65/A^{\frac{1}{3}}$ MeV, just below the well known giant dipole resonance. In addition, brief, qualitative notes are given on the theoretical background to these and other giant resonance phenomena. (auth)

15449 GAMMA RAYS FROM RESONANCE NEUTRON CAPTURE IN ^{115}In. Corvi, F.; Stefanon, M. (Comitato Nazionale per l'Energia Nucleare, Bologna (Italy)). Nucl. Phys., A; 233: No. 1, 185-216(11 Nov 1974).

Gamma rays in the range 5.4 to 6.7 MeV were studied for 31 s-wave neutron resonances of ^{115}In, selected by time of flight in the range 3 to 430 eV. In a subsidiary experiment, spin 5 was assigned to 17 and 4 to 14 resonances by measuring intensity variations of some strong low energy transitions. The reduced widths averaged over all initial states of the same spin were estimated for 41 primary transitions; these values have provided information on the spin and parity of the corresponding ^{116}In final states. Overall mean values of E1 and M1 radiative strength were calculated. The width distribution was fitted with a χ^2 function with $\nu = 1.10^{+0.3}_{-0.2}$ degrees of freedom for M1 and $\nu = 1.42^{+0.4}_{-0.3}$ for E1 radiation. An estimate of the spin cutoff parameter $\sigma = 3.6^{+0.5}_{-0.4}$ was derived. A nonstatistical effect already evidenced in previous measurements was confirmed, consisting of a strong modulation of the radiative strength against resonance energy, correlated also with the local neutron strength function. In addition, it is now shown that this structure is due to E1 radiation only. (auth)

15450 STRUCTURE AND ELECTROMAGNETIC PROPERTIES OF THE DOUBLY EVEN Te ISOTOPES. DeGrieck, E. (Centrum voor Kernwetenschappen, Koninklijke Militaire School, Renaissancelaan 30, Brussel, Belgium); Vanden Berghe, G. (Ghent Rijksuniversiteit (Belgium). Seminarie voor Wiskundige Natuurkunde). Nucl. Phys., A; 231: No. 1, 141-158(7 Oct 1974).

The doubly even Te isotopes ($122 \leq A \leq 134$) were studied in the two-proton core coupling model. The obtained energy levels, wave functions and electromagnetic properties as well as spectroscopic factors for a (^{3}He, d) stripping reaction are compared with experimental data. A comparison between the results of the afore-mentioned model and the variable moment of inertia model is made. (auth)

15451 STUDY OF THE ^{91}Zr(d,^{3}He)^{90}Y REACTION. Cochavi, S.; Gilad, S.; Moinester, M. A.; Alster, J. (Tel Aviv Univ. (Israel). Dept. of Physics and Astronomy); Buenerd, M.; Martin, P. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Nucl. Phys., A; 233: No. 1, 73-80(11 Nov 1974).

The ^{91}Zr(d,^{3}He) reaction was studied at a deuteron energy of 28 MeV. Angular distributions were measured from 13 to 47°; l_p values were extracted for the prominent lines of ^{90}Y. The l_p values and transition strengths were determined by DWBA analysis. The angular distributions for the $(\pi p_{\frac{1}{2}})(\nu d_{\frac{5}{2}})$ doublet (g.s. and 0.20 MeV state) exhibit the characteristic l = 1 shape. States at 1.42, 1.57, 1.64 and 1.81 MeV were also populated strongly in the (d,^{3}He) reaction; the 1.42, 1.57 and 1.81 MeV levels contain l = 1 transition strength and are most likely members of the $(\pi p_{\frac{1}{2}}^{-1})(\nu d_{\frac{5}{2}})$ multiplet. The 2.03 MeV state has a characteristic l = 3 angular distribution and is suggested to be the only member of the $(\pi f_{\frac{5}{2}}^{-1})(\nu d_{\frac{5}{2}})$ sextet to be unambiguously observed in this study, most probably the 5^- or 4^- member. The members of the $(\pi g_{\frac{9}{2}})(\nu d_{\frac{5}{2}})$ sextet were populated weakly (less than 100 μb/sr) in this reaction. (auth)

15452 STUDY OF THE ^{92,96}Zr(d,α)^{90,94}Y REACTIONS. Gilad, S.; Cochavi, S.; Moinester, M. A.; Alster, J. (Tel Aviv Univ. (Israel). Dept. of Physics and Astronomy); Buenerd, M.; Martin, P. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Nucl. Phys., A; 233: No. 1, 81-90(11 Nov 1974).

The hole-hole structure of ^{94}Y was studied via the reaction ^{96}Zr(d,α)^{94}Y and compared to the particle-hole structure of ^{90}Y, which was populated by the reaction ^{92}Zr(d,α)^{90}Y. The deuteron beam energy was 28 MeV. Angular distributions of both reactions were obtained for the prominent lines. New states of ^{94}Y were observed at 0.44, 1.17, 1.39, 1.53, 1.82, 1.90, 2.17, 2.33, 2.46, and 2.77 MeV. The data are consistent with the previously reported 2^- assignment of the ground state, and it is suggested

that $J^{\pi} = 3^-$ for the 0.44 MeV state, these being members of the $(\pi 2p_{\frac{3}{2}}, \nu 2d_{\frac{5}{2}}^{-1})$ doublet. The 1.17 state is suggested to be a member of the $(\pi p_{\frac{3}{2}}^{-1}, \nu d_{\frac{5}{2}}^{-1})$ multiplet. The Q-value of the $^{96}Zr(d,\alpha)^{94}Y$ reaction was measured to be 7.609 ± 0.020 MeV. The reaction $^{94}Zr(d,\alpha)$ was performed at two angles. Several new states of ^{92}Y were observed at 0.31, 0.78, 1.03, 1.31, 1.49, 1.69 and 1.89 MeV. (auth)

15453 NUCLEAR DATA SHEETS: RECENT REFERENCES. Nucl. Data Sheets; 14: No. 1, 1-118(1 Jan 1975).

This publication is a current guide to experimental nuclear physics papers, issued three times a year. The information is described by a key word string, from which the user should be able to tell whether the indexed papers contain results relevant to his interests. Each issue supplements earlier ones, the present volume covering literature received by the Nuclear Data Project or assigned key numbers between May 1 and August 31, 1974. Recent References contains three major sections: key numbers and key words, reaction index, and references. (RWR)

15454 A TABLE OF THE γ-RAYS OF ALL KNOWN RADIONUCLIDES. Erdtmann, G.; Soyka, W. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Zentralinstitut fuer Analytische Chemie). Nucl. Instrum. Methods; 121: No. 1, 197-201 (1 Oct 1974).

A compilation of all γ-rays observed in the decay of the radionuclides is described. This compilation is available as tabulation and as a data set stored on a magnetic tape. Programs for handling this data tape are described. (auth)

15455 ATTENUATION OF THE DOPPLER SHIFT IN GAMMA-RAY ENERGY IN THE COULOMB EXCITATION OF ^{95}Mo AND ^{97}Mo. Erokhina, K. I.; Zhurgulevichus, R. K.; Lemberg, I. Kh.; Pasternak, A. A. Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 710-720(Apr 1974). (In Russian).

From 24th annual conference on nuclear spectroscopy and nuclear structure; Kharkov, USSR (29 Jan 1974). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

The attenuation of the Doppler shift of the γ energy emitted as a result of the Coulomb excitation of ^{95}Mo and ^{97}Mo was studied. The lifetimes of the excited levels were measured as $3.1^{+1.0}_{-0.8}$ nsec for 948.3 keV and 0.57 ± 0.14 nsec for 1047 keV levels of ^{95}Mo and 0.69 ± 0.15 nsec for 1024.6 keV, 1.3 ± 0.4 for 1116.7 keV, and 0.67 ± 0.24 nsec for 1268.8 keV levels of ^{97}Mo. The following lifetimes were evaluated: 480.9 keV (≥ 3 nsec), 679.6 keV (≥ 3 nsec), 719.3 keV (≥ 1 nsec), and 721.1 keV (≥ 1 nsec) for ^{97}Mo. The mixing parameters were determined for some γ transitions and the values B(M1)↓ were calculated. (tr-auth)

15456 QUASI-ROTATIONAL BANDS IN NEUTRON DEFICIENT DOUBLY EVEN Ba ISOTOPES. Conrad, J.; Repnow, R.; Grosse, E.; Homeyer, H.; Jaeschke, E.; Wurm, J. P. (Max-Planck-Institut fuer Kernphysik, Heidelberg (F.R. Germany)). Nucl. Phys., A; 234: No. 1, 157-166(25 Nov 1974).

By bombarding targets of ^{110}Cd, ^{108}Cd and ^{106}Cd with ^{16}O ions of 52.5-66 MeV, the neutron-deficient isotopes ^{124}Ba, ^{122}Ba and ^{120}Ba were produced and their ground-state bands were investigated. To identify ^{120}Ba, which has 18 neutrons less than the most abundant barium isotope, neutron-gamma coincidences had to be applied in addition to charged-particle and gamma-gamma coincidence measurements. The upper limit for the lifetime of the ground state of ^{120}Ba is 90 sec. In the very light barium nuclei the moment of inertia and the rotational character is still increasing slowly with decreasing neutron number. (auth)

15457 SYSTEMATICS OF GIANT RESONANCES FROM INELASTIC ALPHA-PARTICLE SCATTERING. Moss, J. M.; Rozsa, C. M.; Bronson, J. D.; Youngblood, D. H. (Texas Agricultural and Mechanical Univ., College Station (USA). Cyclotron Inst.). Phys. Lett., B; 53: No. 1, 51-53(11 Nov 1974).

The giant resonance region was studied for 15 nuclei from ^{24}Mg to ^{208}Pb by inelastic scattering of 96 and 115 MeV α-particles. A peak is observed at an excitation energy of $\sim 63/A^{\frac{1}{3}}$ MeV for all nuclei with A ≥ 40. The angular distribution in ^{90}Zr shows a diffraction structure which is in phase with L = 0 and L = 2 DWBA predictions. The peaks are narrower for closed nuclei and no splitting is observed for the deformed nuclei. (auth)

15458 GENERALIZED NEUTRON PARTICLE-HOLE STATES IN AN EXTENDED UNIFIED MODEL. Heyde, K.; Waroquier, W.; Vincx, H. (Ghent Rijksuniversiteit (Belgium). Natuurkundig Lab.); Brussaard, P. J. (Rijksuniversiteit Utrecht (Netherlands). Fysisch Lab.). Nucl. Phys.; 234A: No. 1, 216-252(25 Nov 1974).

Negative-parity levels in the doubly even N = 82, Z nuclei, with 3.0 MeV ≲ E_x ≲ 6.0 MeV, are described in an extended unified-model approach, where neutron hole states in the Z = 50, N = 82 closed shell core (i.e. $2d_{\frac{5}{2}}^{-1}$, $3s_{\frac{1}{2}}^{-1}$, $2d_{\frac{3}{2}}^{-1}$, $1g_{\frac{7}{2}}^{-1}$) are coupled to the low-lying levels (Ex ≲ 2.0 MeV) of the odd-neutron N = 83, Z nuclei. This particular configuration space of generalized neutron particle-hole states (GNPH) is particularly suited for describing negative-parity levels obtained in proton inelastic scattering, through isobaric analog resonances (IAR), corresponding to the N = 83, Z low-lying nuclear levels. Level schemes as well as partial decay widths and angular distributions are calculated and compared extensively with the available experimental data. Also spectroscopic factors, as well as wave functions, deduced from the experimental results are studied in detail. Thus, in the cases of ^{136}Xe, ^{138}Ba, ^{140}Ce, ^{142}Nd, and ^{144}Sm, some of the important neutron particle-hole configurations can uniquely be determined in the energy region 3.0 MeV ≲ E_x ≲ 6.0 MeV. (auth)

15459 NEW GIANT RESONANCES IN NUCLEI. An Interim Review. Satchler, G. R. (Oak Ridge National Lab., Tenn. (USA)). Phys. Rep.; 14: No. 3, 97-127(Nov 1974).

107 refs.

The recent evidence for new giant multipole resonances in nuclei is reviewed, particularly for a supposedly isoscalar quadrupole resonance with an excitation energy of about 60 to 65/$A^{\frac{1}{3}}$ MeV, just below the well-known giant dipole resonance. In addition, brief, qualitative notes are given on the theoretical background to these and other giant resonance phenomena. (auth)

Nuclear Properties and Reactions, 150 ≤ A ≤ 189

Refer also to abstracts 15400, 15437, 15443, 15453, 15459, 15508, 15531, and 15548.

15460 (IPNO-PhN-73-02) EVIDENCE FOR CRITICAL NUCLEI APPEARING AS SUPERSOFT FAR FROM THE STABILITY LINE. Foucher, R. (Paris-11 Univ., 91-Orsay (France). Div. de Physique Nucleaire). Jan 1973. 13p. (In French). Dep. NTIS (US Sales Only) $4.00.

The extrapolation of the calculations made and of the known experimental data in stable or almost stable nuclei has shown that soft or critical states in heavy nuclei had to be sought around platinum nuclei (Z = 78, N = 108). There are chances of finding there types of nuclear phases difficult to observe near stability. Nuclei of the mercury-platinum region were obtained by bombarding gold or lead with a 155-MeV or 600-MeV proton beam. Nuclei are studied in the same manner as are macroscopic states, with their phases, phase transitions, and degrees of asymmetry and order-disorder. The study of unstable nuclei seems to show that when there is maximum instability in relation to one degree of asymmetry, there is instability with respect to the other degrees of asymmetry, and each area does in fact seem to have critical nuclei supersoft in appearance. (FR)

15461 (IPNO-TS-74-1) STUDY OF THE (Ar,xn) REACTIONS IN THE Pt-Po AREA AND PROSPECTS FOR THE PRODUCTION OF NEW ISOTOPES PRODUCED BY (Ca,xn) REACTIONS. Lagarde, B. (Paris-11 Univ., 91-Orsay (France). Inst. de Physique Nucleaire). May 1974. 55p. (In French). INIS.

Thesis.

The purpose is to present what are the neutron deficient isotopes which can be produced with a beam of Ca ions in the area of Pt, Pb, Bi, Po. The α decay and half-life will identify them. The well known helium jet technique was used to collect recoils. For this same area, the results obtained with a beam of Ar ions produced by the accelerator ALICE at ORSAY were put together; an analysis of these results has allowed one to put the maximum in energy of excitation functions for (Ca,xn) reactions and a fission-evaporation simple calculation (n,p,α) has allowed one to calculate the cross sections of new isotopes produced by (ar,xn) reactions. At last, with α decay systematics, the energies Eα and half-lives $T_{\frac{1}{2}}$ of these new isotopes have been estimated. (auth)

15462 (LYCEN-7372) DE-EXCITATION OF TWO QUASI-PARTICLE STATES FED BY $\frac{7}{2}(p)[523] \rightarrow \frac{5}{2}(n)[523]$ TYPE DECAY IN ^{168}Yb, ^{164}Er, AND $^{158,160,162}Dy$ NUCLEI. Charvet, A. (Lyon-1 Univ., 69-Villeurbanne (France). Inst. de Physique Nucleaire). Dec 1973. 96p. (In French). Dep. NTIS (US Sales Only) $8.00.

Thesis.

The existence was established of the hitherto little known $^{168}Lu(f)$ (5,5mn) and $^{168}Lu(m)$ (6,7mn) decays. These decays were studied. The following decays were also investigated: $^{164}Tm(m)$ (4.9mn), $^{158}Ho(f)$ (11mn), $^{160}Ho(f)$ (27mn) and $^{162}Ho(m)$ (68mn). In addition, a dozen lifetimes were measured or estimated for energy states in excess of 1.5 MeV. These decays were considered because

they involve the p[523] spin-up → n[523] spin-down a.u. (allowed-unhindered) transition which leads to two quasi-particle states having an essentially pure configuration. This particularity facilitates, in principle, the understanding of other excited states. The high complexity of the excited states of even deformed nuclei due to the mixing of two quasi-particle states and quasi-particle interactions is illustrated by comparisons between theory and experiment and by discussions on the behavior of such systems. The 1998 and 2110 keV levels of ^{168}Yb form a 5$^-$, 6$^-$ band built on a state having an essentially p[411] spin-up + p[523] spin-up configurations while similar ^{164}Er states have a much more complex structure. It was shown that among the states de-exciting towards the gamma band, the contribution of the two-phonon state of the 1694 keV level of ^{168}Dy is small. (auth)

15463 NUCLEAR DEFORMATIONS FROM INELASTIC α-SCATTERING ON RARE EARTH NUCLEI AT ENERGIES NEAR THE COULOMB BARRIER. Brueckner, W.; Husar, D.; Pelte, D.; Traxel, K. (Max-Planck-Institut fuer Kernphysik, Heidelberg (F. R. Germany)); Samuel, M.; Smilansky, U. (Weizmann Inst. of Science, Rehovoth (Israel)). Nucl. Phys., A; 231: No. 1, 159-175(7 Oct 1974).

Alpha particles in the energy range of 10 to 20 MeV and scattered at various angles were used to excite the 0$^+$, 2$^+$, 4$^+$ members in the ground state bands of ^{152}Sm, ^{154}Sm and ^{186}W. The measured excitation probabilities for bombarding energies below the Coulomb barrier were analyzed in the framework of Coulomb excitation theory. The resulting matrix elements of the E2 and E4 multipole operators were interpreted in terms of charge deformation parameters $\beta^c_{\lambda=2,4}$. The cross sections for higher energies were analyzed in terms of the deformed optical potential and resulted in potential deformation parameters $\beta^p_{\lambda=2,4}$. The two sets of deformation parameters show the same general trend of variation with target mass number. Still, significant differences are observed in some particular cases. (auth)

15464 PHASE TRANSITION FROM DEFORMED TO γ-INSTABLE Os ISOTOPES AND THE STRUCTURE OF THE GIANT RESONANCES. Sedlmayr, R.; Sedlmayr, M.; Greiner, W. (Frankfurt Univ. (F. R. Germany). Inst. fuer Theoretische Physik). Nucl. Phys., A; 232: No. 2, 465-471(4 Nov 1974).

The collective potential energy surfaces and kinetic energies are constructed empirically by using the experimental low energy spectra for the Os isotopes. Giant dipole resonances and photon scattering are calculated within the DCM based in the so-obtained collective Hamiltonian. The potential energy surfaces show a phase transition from prolately deformed (Os) to γ-instable (Os) nuclei. This is also reflected in the structure of the giant resonances. (auth)

15465 INVESTIGATIONS WITH TWO-NEUTRON TRANSFER REACTIONS ON THE EVEN ISOTOPES OF SAMARIUM. Oelert, W.; Lindstroem, G.; Riech, V. (Hamburg Univ. (F. R. Germany). 1. Inst. fuer Experimentalphysik). Nucl. Phys., A; 233: No. 1, 237-264(11 Nov 1974).

The (p,t) reaction on the even isotopes of samarium has been investigated at a proton energy of 25.5 MeV. Angular distributions were obtained in the range $18° \leq \theta \leq 148°$ with angular steps between 2° and 5°. The experimental energy resolution varied between 35 keV and 50 keV FWHM. Spin and parity assignments are performed by comparing the measured angular distributions to zero-range DWBA calculations. Some difficulties of DWBA calculations for (p,t) reactions are pointed out. The relative cross sections for transitions to different levels of the final nuclei are compared with other (p,t) and (t,p) measurements in the same region of the rare earth isotopes. The dependence of the (p,t) cross sections for different transitions on the neutron number of the final nuclei is discussed. Some 2$^+$ states observed in (p,t) and (t,p) reactions are described in the quadrupole pairing vibrational picture. (auth)

15466 THE (n_{th},α) REACTION ON ^{147}Sm, ^{151,153}Eu AND Yb ISOTOPES. Emsallem, A.; Do Huu Phuoc; Chery, R. (Lyon-1 Univ., 69 – Villeurbanne (France). Inst. de Physique Nucleaire); Asghar, M. (Institut Max von Laue–Paul Langevin, 38 – Grenoble (France)). Nucl. Phys., A; 231: No. 3, 437-444(21 Oct 1974).

The (n,α) reaction has been studied using the highly pure thermal neutron beam from the 87-m curved neutron guide at the Grenoble high-flux reactor. The ^{147}Sm(n,α)^{144}Nd reaction showed up five lines corresponding to the ground and the first four excited states of the final nucleus. It is shown that ≈53% of the 581 μb (n,α) cross section comes from the neutron capture by a bound level of the ^{148}Sm compound nucleus. The 8.7 ± 3 μb cross section of ^{151}Eu(n,α)^{148}Pm seems to consist principally of at least two lines corresponding to the ground and the second excited states of ^{148}Pm. The ^{153}Eu(n,α)^{150}Pm cross section for thermal neutrons is ≤ 1 μb. The lower limits of (n,α) thermal neutron cross section values on ytterbium isotopes are ≈20 to 40 times lower than the published data. (auth)

15467 WIDTHS FOR s- AND d-WAVE α-DECAY OF NEUTRON-DEFICIENT ISOTOPES WITH Z ≤ 82. Hornshoej, P. (Aarhus Univ. (Denmark)); Hansen, P. G.; Jonson, B.; Ravn, H. L.; Westgaard, L. (European Organization for Nuclear Research, Geneva (Switzerland)); Nielsen, O. B. (Niels Bohr Institutet, Copenhagen (Denmark)). Nucl. Phys., A; 230: No. 3, 365-379(30 Sep 1974).

The α-decay of the nuclides $^{186-192}$Pb, ^{180}Hg, and ^{176}Pt has been studied after on-line mass separation of spallation products from reactions with 600 MeV protons. For the lead isotopes, the K X-ray/α ratios were determined; and from these, partial α half-lives were deduced. In the decay of 6-sec ^{176}Pt, a 1.4% α branch was found to the 228 keV 2$^+$ level of ^{172}Os, while for ^{180}Hg an upper limit of 10^{-3} (relative to the ground-state α branch) could be put on the intensity of an assumed rotational fine-structure component. The systematics of reduced s-wave (0$^+$ → 0$^+$) α widths is discussed. The lead isotopes show a surprising trend: the reduced s-widths vary from a very small value for ^{186}Pb (deduced from the heavy-ion cross sections of Gauvin et al.) to a quite large value for ^{192}Pb. The systematics of d-wave (0$^+$ → 2$^+$) hindrance factors (relative to the ground-state branch) shows that these range from 1 to 4 for the actinides, while for platinum and mercury one finds 8 and ~ 50, respectively. (auth)

15468 ROTATIONAL BANDS IN ^{169}Tm OBSERVED IN THE ^{170}Er(p,2n)^{169}Tm AND ^{170}Er(d,3n)^{169}Tm REACTIONS. Barneoud, D.; Foin, C.; Andre, S.; Abou-Leila, H.; Hjorth, S. A. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Nucl. Phys., A; 230: No. 3, 445-465(30 Sep 1974).

Cascade and cross-over transitions within the 1/2$^+$[411], 1/2$^-$[541], 1/2$^+$[404] and 1/2$^-$[523] rotational bands are observed when excited levels in ^{169}Tm are populated in the ^{170}Er(p, 2n)^{169}Tm and ^{170}Er(d, 3n)^{169}Tm reactions. The deexcitation of levels in the 1/2$^-$[541] band proceeds to a large extent through interband transitions into levels in the 1/2$^+$[411] band. This allows for a unique location of the 3/2$^-$ and 5/2$^-$ members of the 1/2$^-$[541] band at 475.1 and 345.1 keV, respectively. The excitation energy of the 1/2$^-$[541] band head is very tentatively suggested to be 342.0 keV above the ^{169}Tm ground state. The rotational excitations are discussed in terms of a model where a particle is coupled to a rotor with a variable moment of inertia. In this way the trend of the transition energies in the two K = 1/2 bands is amazingly well reproduced. However, in the two K = 1/2 bands such a good description of the experimental energies can only be obtained if the moment of inertia for the levels having $a_{decp}(-)^{I+1/2}$ equal to a positive number grows more rapidly with spin than for the levels where $a_{decp}(-)^{I+1/2}$ is negative. (auth)

15469 MOESSBAUER-EFFECT STUDIES OF EXCITED STATES OF ^{155}Gd, ^{156}Gd AND ^{157}Gd. Armon, H.; Bauminger, E. R.; Diamant, A.; Nowik, I.; Ofer, S. (Hebrew Univ., Jerusalem (Israel)). Nucl. Phys., A; 233: No. 2, 385-394(18 Nov 1974).

Moessbauer-effect studies yield the following nuclear parameters: in ^{155}Gd, Q(86)/Q(0) = 0.087 ± 0.006, Q(105)/Q(0) = 1.00 ± 0.03; in ^{156}Gd, g(89) = 0.386 ± 0.004, ^{156}Q(89)/^{155}Q(0) = −1.51 ± 0.02; in ^{157}Gd, Q(64)/Q(0) = 1.80 ± 0.03 and g(64) = −0.185 ± 0.005. The value of g(89) is in very good agreement with the theoretical value. (auth)

15470 MEASUREMENT OF TRANSITION QUADRUPOLE AND HEXADECAPOLE MOMENTS IN EVEN–EVEN RARE EARTH NUCLEI. Shaw, A. H. New Haven; Yale Univ. (1974). 235p. University Microfilms Order No. 74-26,338.

Thesis (Ph. D.).

The deformations of the charge distributions of the eight even-even rare earth nuclei ^{152}Sm, ^{154}Sm, ^{158}Gd, ^{160}Gd, ^{164}Dy, ^{166}Er, ^{168}Er, and ^{174}Yb were investigated in a Coulomb excitation experiment in which elastically and inelastically scattered ^{4}He projectiles were detected at back angles in an annular Si surface barrier detector. Up to ten determinations of the 2$^+$ and 4$^+$ state excitation probabilities for each nucleus, with individual accuracies for each measurement of 1% to 2% and 2% to 4% respectively, were analyzed both with the semi-classical Coulomb excitation calculation corrected for quantal effects using second order perturbation theory, and a full quantal calculation, to yield the reduced transition electric multipole matrix elements (transition moments) M(E2; 0$^+$ → 2$^+$) and M(E4;0$^+$ → 4$^+$). These moments are directly related to the intrinsic electric quadrupole and hexadecapole moments, respectively, within the context of the collective model. Large hexadecapole moments and accompanying pronounced E4 contributions to the excitation of the 4$^+$ state were observed in ^{152}Sm, ^{154}Sm, and ^{158}Gd; these were found to be smaller for the other

nuclei studied. Differences between the perturbation theory quantal corrections and the full quantal calculation were explored. Investigations of the interference between Coulomb and nuclear potential scattering amplitudes were conducted in order to determine the incident projectile energy range within which the interaction can be considered pure Coulomb. A deformed Fermi charge distribution was assumed in order to calculate the Coulomb deformation parameters β_2^C and β_4^C, from intrinsic moments. These deformation parameters were examined as a parameterization of the charge distribution, and the degree to which they could be related to measurements of the deformation of the nuclear potential was explored. (Diss. Abstr. Int., B)

15471 $^{184}Au \rightarrow {}^{184}Pt$ DECAY ($T(^1/_2) = 53.0 \pm 1.4s$). Cailliau, M.; Foucher, R.; Husson, J. P.; Letessier, J. (Paris Univ., Orsay, France). J. Phys. (Paris); 35: No. 6, 469-482(Jun 1974). (In French).

The $^{184}Au \rightarrow {}^{184}Pt$ decay, studied on-line with the ISOLDE facility (CERN) is presented, γ and conversion electron spectra as well as γ-γ (theta) anisotropy measurements are given. A level scheme is proposed. The energy of the first 0^+ excited state is found anomalously low (492.0 keV), as in ^{186}Pt. These two nuclei are located in a complex shape fluctuation region. (auth)

15472 SPECTROSCOPIC QUADRUPOLE MOMENT OF HOLMIUM FROM PIONIC X-RAY MEASUREMENT. Ebersold, P.; Aas, B.;Dey, W.; Eichler, R.; Hartmann, J.; Leisi, H. J.; Sapp, W. W. (Schweizerisches Inst. fuer Nuklearforschung, Villigen). Phys. Lett.; 53B: No. 1, 48-50(11 Nov 1974).

From the observed quadrupole splitting of the 5g-4f X-ray transition in π-^{165}Ho the spectroscopic quadrupole moment of ^{165}Ho is determined to be $Q = 3.47 \pm 0.11$ b. The strong interaction shift and the width of the 4f level are found to be $\epsilon_0 = 0.35 \pm 0.08$ keV and $\Gamma_0 = 0.21 \pm 0.04$ keV, respectively. (auth)

15473 DEPENDENCE OF NUCLEAR DEORIENTATION ON NUCLEAR SPIN FOR RECOILS IN VACUUM. Ward, D.; Andrews, H. R.; Graham, R. L.; Geiger, J. S. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.); Rud, N. (Aarhus Univ. (Denmark)). Nucl. Phys.; 234A: No. 1, 94-108(25 Nov 1974).

Time-integral measurements have been made of the vacuum deorientation of the 2^+ and 4^+ states in ^{150}Sm and the 6^+ and 8^+ states in ^{156}Gd Coulomb-excited by 133-MeV ^{35}Cl ions. The ^{150}Sm results were deduced from γ-ray angular distributions measured in coincidence with backscattered ^{35}Cl ions. In the ^{156}Gd measurements, a fixed counter array and a sandwich target were used to measure directly the differences between the γ-ray angular distributions from nuclei recoiling in vacuum and the unperturbed γ-ray angular distributions from nuclei stopped in a thick ^{156}Gd target. The measured deorientation time constants in ps are $\tau_2(2^+) = 27 \pm 4$; $\tau_2(4^+) = 14 \pm 4$; $\tau_2(6^+) = 24 \pm 3$; $\tau_2(8^+) = 23^{+10}_{-5}$; $\tau_4(2^+) = 12 \pm 2$; $\tau_4(4^+) = 5 \pm 3$; $\tau_4(6^+) = 7.6 \pm 2.5$. The 8^+ data were analyzed assuming $\tau_2/\tau_4 = {}^{10}/_3$ as predicted by the Abragam-Pound theory for $I \geq 4$ essentially independently of the degree of quadrupole admixture. The other results are consistent with this except for the 2^+ level, which shows some quadrupole effect. The present results, which show strong deorientation of high-spin levels, are in contrast to earlier work on neutron-deficient Er isotopes. In light of the findings it is suggested that the failure to observe deorientation in the high-spin states in Er is primarily due to anomalously low g factors associated with the backbending observed in these nuclei. (auth)

Nuclear Properties and Reactions, 190 ≤ A ≤ 219

Refer also to abstracts 15320, 15349, 15373, 15393, 15432, 15445, 15453, 15459, 15461, 15464, 15467, and 15500.

15474 (BNL-tr-581) π^+-MESON DOUBLE CHARGE EXCHANGE OF ^{209}Bi NUCLEI. Batusov, Yu. A.; Ganzorig, Zh.; Dudova, I. V.; Osipenko, B. P.; Sidorov, V. M.; Khalkin, V. A.; Chultem, D. (Joint Inst. for Nuclear Research, Dubna (USSR)). [nd]. Translation by S. J. Amoretty of JINR-P1-6961. 15p. Dep. NTIS $4.00.

The reactions of the double charge exchange of π^+-mesons on bismuth nuclei: $\pi^+ + {}^{209}Bi \rightarrow {}^{209-x}At + \pi^- + xn$ were studied. Identification of astatine isotopes or the daughter polonium-product was performed by the α-particle registration and their energy measurements. The $\pi^+ + {}^{209}Bi \rightarrow \pi^- + {}^{207}At + 2n$ reaction cross section was found to be $(12 \pm 3) \cdot 10^{-29}$ cm^2. Estimate of the cross section upper limit for the elastic double charge exchange of π^+-mesons on Bi nuclei is $\leq 10^{-29}$ cm^2. Possible mechanism of ^{211}At production in the reaction $\pi^+ + {}^{209}Bi \rightarrow {}^4He + \ldots {}^4He + {}^{209}Bi \rightarrow {}^{211}At + 2n$ is considered. (auth)

15475 (COO-535-710, pp 35-36) $^{197}Au(^6He,d)^{198}Hg$ REACTION AT 38 MeV. Munger, M. L. 1 Nov 1974.

In technical progress report, November 1, 1973-November 1, 1974.

15476 (IPNO-1972) 1972 ANNUAL REPORT. (Paris-11 Univ., 91-Orsay (France). Inst. de Physique Nucleaire). [nd]. 108p. (In French). Dep. NTIS (US Sales Only) $8.50.

Experiments in nuclear physics and high energy physics are presented together with theoretical work on nuclear structure. The accelerators are described. (FR)

15477 (IPNO-T-74-08) STUDY OF THE ^{84}Kr IONS SCATTERING BY HEAVY NUCLEI. Colombani, P. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1974. 101p. (In French). Dep. NTIS (US Sales Only) $8.25.

Thesis.

The elastic and inelastic scattering of ^{84}Kr from heavy targets above the Coulomb barrier (4 to 5 MeV per nucleon) was experimentally studied to get a better understanding of the interaction mechanism at large distances of closest approach. Deformed and spherical targets were used: ^{208}Pb, ^{232}Th, ^{197}Au, ^{84}Kr being itself a vibrational nucleus. The scattering process was shown strongly dependent on the importance of the Coulomb interaction (which leads to very high cross sections for the excitation of the collective levels of deformed nuclei), the deformation of the interacting nuclei; this was interpreted in the framework of a semi-classical formalism using a realistic form of the nucleus-nucleus interaction potential. (auth)

15478 DECAY OF ^{209}At TO LEVELS IN ^{209}Po. Jardine, L. J.; Prussin, S. G.; Hollander, J. M. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Nucl. Phys., A; 233: No. 1, 25-47(11 Nov 1974).

The electron-capture decay of ^{209}At was investigated, and present data define twenty-one levels in ^{209}Po. The multipolarities of thirty-six transitions were deduced and combined with data from recent reaction studies to assign spins and parities to levels. Evidence is presented to identify seniority one and seniority three states below 2.3 MeV which arise from couplings of the one-neutron hole with two-proton configurations. A calculation using experimental data from neighboring isotopes in the lead region to approximate residual interactions was found to give remarkable agreement with the experimental level structure below 1.6 MeV. First-forbidden electron-capture transition rates to even parity levels at 2.3 and 2.9 MeV in ^{209}Po are discussed with reference to the $g_{9/2}$ and $i_{13/2}$ seniority one neutron states. (auth)

15479 THE STRUCTURE OF ^{209}Bi. I. Microscopic Structure from Analog Resonances. Cleary, T. P.; Stein, N.; Maurenzig, P. R. (Yale Univ., New Haven, Conn. (USA). Nuclear Structure Lab.). Nucl. Phys., A; 232: No. 2, 287-310(4 Nov 1974).

Excitation functions for the $^{209}Bi(p,p')$ reaction were measured for incident proton energies from 14.0 to 15.5 MeV to study the population of states in ^{209}Bi via decay of the isobaric analog resonances in the compound nucleus ^{210}Po. The analogs correspond to parent states in the lowest one MeV of excitation in ^{210}Bi. Strong resonances are observed in the excitation functions for twenty proton groups corresponding to levels between 2.75 and 3.65 MeV in ^{209}Bi. From these results, levels which possess microscopic 2p-1h structure involving the $h^\pi_{9/2}$, $g^\nu_{9/2}$ and $p^{-1\nu}_{1/2}$ orbitals are identified and their ^{210}Bi parentage determined. The resonant scattering results together with other direct inelastic scattering data allow the spins and parities for many of the levels to be deduced. The results of a microscopic calculation, in which empirical two-body matrix elements are employed to describe the interactions between the $h^\pi_{9/2}$, $g^\nu_{9/2}$ and $p^{-1\nu}_{1/2}$ orbitals, are also reported and compared with the experimental results for levels in ^{209}Bi. The excellent agreement between theory and experiment demonstrates that the general character of these levels can be understood microscopically in terms of their 2p-1h structure. (auth)

15480 EVIDENCE FOR A $^{13}/_2^-$ ISOMERIC STATE IN ^{205}Po. Ohya, S.; Shida, Y.; Yoshikawa, N. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study); Numao, T. (Tokyo Inst. of Tech. (Japan). Dept. of Physics). Nucl. Phys., A; 233: No. 1, 20-24(11 Nov 1974).

A new isomer with a half-life of 62 ± 5 ms was observed in ^{205}Po by the reaction ^{209}Bi (p,5n)^{205m}Po. Prompt and delayed spectra of γ-rays and internal conversion electrons were measured using Ge(Li) and Si(Li) detectors. The 1461 keV isomer decays by an E3 transition with an energy of 580.8 keV and the spin-parity is assigned as $^{13}/_2^-$. (auth)

15481 THE STRUCTURE OF ^{209}Bi. II. Macroscopic Structure from Direct Scattering. Cleary, T. P.; Stein, N.; Callender, W. D.; Bromley, D. A. (Yale Univ., New Haven, Conn. (USA). Nuclear Structure Lab.); Coffin, J. P.; Gallmann, A. (Centre National de la Recherche Scientifique, 67 – Strasbourg (France). Centre de Recherches Nucleaires). Nucl. Phys., A; 232: No. 2, 311-332(4 Nov 1974).

A high resolution study of the ^{209}Bi(p,p') reaction was conducted at incident proton energies of 14.95 and 16.10 MeV to compare the resonant and direct excitations, respectively, of levels in ^{209}Bi. The energies for transitions to over eighty levels in ^{209}Bi up to an excitation energy of 4.4 MeV were measured, many of which have not been reported previously. Angular distributions from the 16.10 MeV direct scattering measurement are compared with angular distributions from proton scattering on ^{208}Pb performed at the same incident energy, and those groups of levels in ^{209}Bi corresponding to the 3^- (2.615 MeV), 5^- (3.198 MeV), and 2^+ (4.086 MeV) excitations of the ^{208}Pb core are identified. The macroscopic weak-coupling model is employed in a discussion of these results and, while the description of these levels in terms of excitations of ^{208}Pb is shown to be qualitatively correct, several significant differences between the simple model and the data are observed. In particular, for levels corresponding to the $h_{9/2} \otimes {}^{208}$Pb(5^-) configurations, it is emphasized that the microscopic 2p-1h structure of the excitations must be considered in order to account for the direct transition strengths. (auth)

15482 HIGH-SPIN STATES IN ^{191,193,195}Au. Tjoem, P. O.; Maier, M. R.; Benson, D. Jr.; Stephens, F. S.; Diamond, R. M. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Nucl. Phys., A; 231: No. 3, 397-410(21 Oct 1974).

The ^{191,193,195}Au nuclei have been studied by means of the (α, x$n\gamma$) and (Li, x$n\gamma$) reactions. A decoupled band built on the $h_{11/2}$ orbital has been identified in all three nuclei. Also, a considerable number of lower- and intermediate-spin levels based on this orbital have been observed and compared with the expectations from a simple rotation-aligned coupling scheme. Isomeric states were also observed in these three gold nuclei, having an energy of about 2 MeV and probable spin $21/2^+$. This state is most likely due to a coupling of the aligned $h_{11/2}$ hole with the 5^- states observed in the nearby even Pt, Hg, and Pb nuclei. The nature of these 5^- states is discussed. (auth)

15483 PROPERTIES OF SINGLE-PARTICLE STATES IN THE ^{208}Pb REGION. Reich, S.; Sofia, H. M.; Bes, D. R. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). Nucl. Phys., A; 233: No. 1, 105-120(11 Nov 1974).

The properties of single-particle states in the ^{208}Pb region are obtained by subtracting from the empirical values the dressing effects of the multipole particle-hole and pairing phonons. Use is made of the particle-vibration formalism. Single-particle energies, one-body transfer spectroscopic factors and effective quadrupole charges are examined within this framework. (auth)

15484 MAGNETIC MOMENT OF THE $29/2^+$ ISOMERIC STATE IN ^{213}Fr. Recknagel, E.; Yamazaki, Y.; Hashimoto, O.; Nagamiya, S.; Nakai, K. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)). Phys. Lett., B; 52: No. 4, 414-416 (28 Oct 1974).

The g-factor of the 0.5-μs $29/2^+$ level in ^{213}Fr was determined to be $g = 1.04 \pm 0.02$ by the stroboscopic resonance method in natural beam bursts of a cyclotron in the ^{204}Hg(^{14}N,4n)^{213}Fr reaction. The observed value strongly supports the configuration of the level to be $(\pi h_{9/2}^{4})_{8+} \otimes \nu i_{13/2}$. The observed g-factor leads to g_l(proton) = 1.06 ± 0.03, and thus gives additional evidence for an anomaly in orbital g-factors. (auth)

15485 MUONIC ^{197}Au: A TEST OF THE WEAK-COUPLING MODEL. Powers, R. J.; Jenkins, D. A. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)); Martin, P.; Miller, G. H.; Welsh, R. E. (College of William and Mary, Williamsburg, Va. (USA)). Nucl. Phys., A; 230: No. 3, 413-444(30 Sep 1974).

The measurement of the energies of various muonic atomic transitions above 500 keV in ^{197}Au is reported. The weak-coupling model was used in order to analyze the hyperfine structure of ^{197}Au. By using transitions to and from the 1s, 2s, 2p and 3p levels as well as the fine structure of the 2p states and hyperfine splittings of the 2p, 3p and 3d states, the data were fitted to two deformed Fermi distributions, one with a constant skin thickness, the other with a skin thickness which varies. Both yield equally good fits. The quadrupole moment of ^{197}Au was determined to be 0.547 ± 0.016 b. The model dependence of the results is discussed. The weak-coupling parameters of de-Shalit, Ω_p, Ω_{22}, Ω_{20} and A^2, have been determined and are in fair agreement with Coulomb excitation results. There is also good agreement between these results and those of electron scattering. (auth)

15486 ALPHA-DECAY WIDTHS OF NEUTRON-DEFICIENT FRANCIUM AND ASTATINE ISOTOPES. Hornshoej, P. (Aarhus Univ. (Denmark)); Hansen, P. G.; Jonson, B. (European Organization for Nuclear Research, Geneva (Switzerland)). Nucl. Phys., A; 230: No. 3, 380-392(30 Sep 1974).

The use of mass-separated samples of neutron-deficient francium isotopes, produced at the ISOLDE on-line mass-separator facility at the CERN 600 MeV synchrocyclotron, has permitted precise determinations through genetic relationships of $\alpha/(EC + \beta^+)$ branching ratios for a range of light francium and astatine isotopes. The experiments verify previous mass assignments and provide improved values for the half-lives. The systematics of α widths and of β strength functions is surveyed. (auth)

15487 EFFECTIVE INTERACTIONS FOR ^{208}Pb + p REACTIONS. Halbert, E. C.; Satchler, G. R. (Oak Ridge National Lab., Tenn. (USA)). Nucl. Phys., A; 233: No. 2, 265-285(18 Nov 1974).

RPA hole–particle wave functions for the lowest 2^+ and 3^- states in ^{208}Pb were used to test the validity of effective nucleon–nucleon interactions for (p,p') excitations. Excellent agreement with experiment was obtained for the long-range part of the Hamada–Johnston S-state potential. Equally good agreement was found for the elastic scattering from ^{208}Pb and the (p,n) transition to the analog state. It was found to be important to include an imaginary part in the interaction. The transitions to the two excited states of ^{208}Pb were found to be almost pure isoscalar, but the transitions are dominated by the neutron excitations. (auth)

15488 THE (p,n) REACTION TO THE ISOBARIC ANALOGUE STATE OF HIGH-Z ELEMENTS AT 25.8 MeV. Schery, S. D.; Lind, D. A.; Fielding, H. W.; Zafiratos, C. D. (Colorado Univ., Boulder (USA). Dept. of Physics and Astrophysics). Nucl. Phys.; 234A: No. 1, 109-129(25 Nov 1974).

Angular distributions have been measured for the (p,n) reaction to the isobaric analogue state of the targets ^{197}Au, ^{206}Pb, ^{207}Pb, ^{208}Pb, ^{209}Bi, and ^{232}Th at a proton energy of 25.8 MeV. Results of distorted-wave Born-approximation calculations indicated that angular distributions were predicted well by both real and complex form factors, although there was less sensitivity to an imaginary surface term than found in previous studies for lower-Z elements. An isospin correction to parameters for proton elastic scattering as determined from (p,n) quasi-elastic scattering was used to predict neutron elastic scattering in an application of the isospin model due to Lane. Although the isospin correction appeared necessary, it was not sufficient to provide adequate agreement with neutron elastic scattering data. A microscopic interpretation of the form factor provided a model in which angular distributions could be predicted well by a real form factor involving only two free parameters. This model was also used to determine the ratio of the rms radii of the neutron matter distribution to the proton matter distribution in ^{208}Pb and gave the result $\langle r_n^2 \rangle^{1/2} / \langle r_p^2 \rangle^{1/2} = 1.07 \pm 0.02$. (auth)

Nuclear Properties and Reactions, A ≥ 220

Refer also to abstracts 15323, 15453, 15461, 15477, 15488, 15527, and 15555.

15489 (EUR-5194e) HALF-LIVES OF SOME LONG-LIVED ACTINIDES: A COMPILATION. Vaninbroukx, R. (Commission of the European Communities, Ispra (Italy). Joint Nuclear Research Center; Commission of the European Communities, Geel (Belgium). Central Bureau for Nuclear Measurements). 1974. 40p. Dep. NTIS (US Sales Only) $5.00. EUR B. Fr. 50.-.

A compilation of the reported half-lives of some of the most commonly used long-lived actinides is given. "Best" values and limits of errors are proposed. The compilation shows where further accurate measurements are necessary in order to resolve existing discrepancies. (15 tables) (auth)

15490 (IPNO-PhN-73-10) INELASTIC SCATTERING OF ^{84}Kr FROM ^{232}Th. Colombani, P.; Jacmart, J. C.; Poffe, N.; Riou, M.; Stephan, C.; Singh, P. P.; Weidinger, A. (Paris-11 Univ., 91 – Orsay (France). Inst. de Physique Nucleaire). 1973. 12p. Dep. NTIS (US Sales Only) $4.00.

The inelastic scattering of ^{84}Kr by ^{232}Th was studied at 371 and 450 MeV incident energies and at different angles using the particle-gamma coincidence technique. It is found that for distances of closest approach smaller than about 20 fm, the scattering of Kr by Th is mostly inelastic. At forward angles, the data are in agreement with predicted values from a Coulomb excitation program, but some differences are observed at backward angles. (auth)

15491 (KFKI-73-45) SEARCH FOR RETARDED NEUTRONS FROM SPONTANEOUS FISSION OF ^{252}Cf. Dyachenko, P. P.; Piksaikin, V. M.; Laitai, A. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). Sep 1973. 9p. INIS.

Searched for retarded neutrons emitted from spontaneous fission of ^{252}Cf is reported. A ^{252}Cf source, about 7 mm in diameter and approximately 10^5 fission/sec was used. The neutrons were recorded in coincidence with the fragments by a 22 × 34 mm stylbene crystal placed at an angle of 90° relative to the fragment direction. The neutron spectra for spontaneous fission of ^{252}Cf were measured in an energy range from 400 keV to 6 MeV. From the results of the measurements it can be seen, that the value A, expressing the contribution from retarded neutrons, does not exceed the range of the experimental error. Consequently no evidence of the existence of neutrons in question was obtained. The sensitivity of the present experimental method depends on the energy of the retarded neutrons. Since the energies lie in an energy interval, where the sensitivity is high enough, a value of A above the experimental error should have been observed. (auth)

15492 SEARCH FOR SUPERHEAVY ELEMENTS IN METEORITES. Popeko, A. G.; Skobelev, N. K.; Ter-Akopyan, G. M. (Joint Inst. for Nuclear Research, Dubna (USSR)); Goncharov, G. N. (Leningradskij Gosudarstvennyj Univ. (USSR)). Phys. Lett., B; 52: No. 4, 417-420(28 Oct 1974).

By using neutron multiplicity detectors, neutron emission from the samples of the Saratov, Efremovka and Allende meteorites has been measured. An activity has been detected which exceeds the background due to spontaneous fission of uranium. The possible relation of the activity observed to spontaneous fission of superheavy elements and anomalies in the Xe content of the meteorites is discussed. (auth)

15493 FUSION OF HEAVY NUCLEI IN A CLASSICAL MODEL. Bass, R. (Frankfurt Univ. (F. R. Germany). Inst. fuer Kernphysik). Nucl. Phys., A; 231: No. 1, 45-63(7 Oct 1974).

The fusion of heavy nuclei is analyzed in a classical potential model. A quasielastic two-body potential is derived from the liquid drop model with inclusion of a finite range of interaction. Energy and angular momentum dissipation by friction are considered in the limit of strong localization at the point of contact. The model suggests a classification of fragment pairs in terms of the parameter $x = (e^2/r_0 a_s) Z_1 Z_2 / A_1^{1/3} A_2^{1/3} (A_1^{1/3} + A_2^{1/3})$. The consequences of the model are discussed in detail. It is shown that a large body of data on fusion barriers and fusion cross sections can be reproduced. Predictions are made for heavier systems and higher energies than have been accessible so far. (auth)

15494 SELF-CONSISTENT CALCULATION OF THE FISSION BARRIER OF ^{240}Pu. Flocard, H.; Quentin, P.; Vautherin, D.; Veneroni, M. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire); Kerman, A. K. (Massachusetts Inst. of Tech., Cambridge (USA). Lab. for Nuclear Science). Nucl. Phys., A; 231: No. 1, 176-188(7 Oct 1974).

Completely self-consistent calculations using the Skyrme force were carried out for the fission energy curve of ^{240}Pu. A deformed oscillator basis including 13 major shells is used, and convergence was checked by extending the size of the basis to 15 shells. A double humped barrier is obtained with energies E_A = 9 MeV for the first barrier, E_B = 13 MeV for the second barrier and E_{II} = 4 MeV for the isomeric state. Corrections to the calculation, such as inclusion of nonaxial and symmetric shapes and zero-point rotational motion, are likely to improve quantitative agreement with experimental data. (auth)

15495 RELATIVE PHOTOFISSILITY OF ^{232}Th, ^{235}U, ^{237}Np, AND ^{239}Pu. Ivanov, K. N.; Petrzhak, K. A. Sov. At. Energy (Engl. Transl.); 36: No. 5, 515-517(May 1974).

Translated from At. Energ.; 36: No. 5, 404-405(May 1974).

The integral photofission yields of ^{232}Th, ^{235}U, ^{237}Np, and ^{239}Pu were studied relative to the photofission yield of ^{238}U as maximum bremsstrahlung energy was increased from 5 to 12 MeV. The ^{235}U, Np, and Pu targets were prepared in the form of thin oxide layers; the Th and ^{238}U targets were prepared from metal foils. The material under study and the ^{238}U target were irradiated simultaneously. Photofission yields were corrected for angular anisotropy of the fragment distribution. The results are discussed and compared with those of other workers. Observed structure in the relative photofissilities is taken as evidence of a definite structure in the photofission cross sections of ^{232}Th, ^{235}U, ^{238}U, ^{237}Np, and ^{239}Pu. At values of the maximum bremsstrahlung energy corresponding to removal of a neutron from these nuclei, a change in the energy dependence of the fissility was also observed. (4 figures) (RWR)

15496 HALF LIFE OF ^{252}Cf. Shchebolev, V. T.; Ramendik, Z. A.; Shlyamin, E. A. Sov. At. Energy (Engl. Transl.); 36: No. 5, 507-508(May 1974).

Translated from At. Energ.; 36: No. 5, 399-400(May 1974).

The half-life was measured by using a graphite sphere. The stability of the apparatus was monitored with a Ra(α,n)Be source. The measurements lasted one to three years. The weighted-mean value from this work is 2.628 ± 0.010 years. There are still some small discrepancies among results of various experiments. (1 table) (RWR)

15497 DELAYED-NEUTRON DATA FOR REACTOR-PHYSICS ANALYSIS. Tuttle, R. J. (Rockwell International Corp., Canoga Park, CA). Nucl. Sci. Eng.; 56: No. 1, 37-71(Jan 1975).

Recommended values for delayed-neutron data of principal interest in reactor-physics analysis are presented. These data are the absolute delayed-neutron yield, the delayed-neutron energy spectrum, and the group fractions and decay constants used to describe the time behavior of delayed-neutron production. The recommended values are the result of a review and evaluation of experimental data and empirical correlations. Use of these values is discussed, and several remaining problems are described. (11 figures, 7 tables) (auth)

15498 PROBABILITY OF FISSION BY 1.33-MeV γ-RAYS AND SPONTANEOUS FISSION HALF-LIFE FOR ^{238}U. Ivanov, K. N.; Petrzhak, K. A. Sov. At. Energy (Engl. Transl.); 36: No. 5, 514(May 1974).

Translated from At. Energ.; 36: No. 5, 403(May 1974).

The probability of ^{238}U fission by γ rays with a maximum energy of 1.332 MeV was determined. Fission fragments were recorded with mica fission-track detectors. The effective number of nuclei in the targets was determined by relative measurements. To allow for spontaneous fission and cosmic ray-induced fission of ^{238}U, control targets were kept for 255 days at the irradiator location and in the subway at a depth of 40 m below sea level. Targets were irradiated for 4582 h. The difference in the number of fissions in control and irradiated targets was ascribed to induced fission of ^{238}U. The results correspond to an upper limit of (2.08 ± 2.1) × 10^{-13} b for the cross section. The absolute detection of fission fragments by the track detectors and the number of spontaneous fission events in the control targets led to a determination of a spontaneous fission half-life for ^{238}U of (9.73 ± 0.44) × 10^{15} years. (RWR)

15499 DIRECT DETERMINATION OF THE NUCLEAR CHARGE DISTRIBUTION OF MASS SEPARATED FISSION PRODUCTS FROM ^{235}U(n_{th},f). Siegert, G.; Greif, J.; Asghar, M.; Bailleul, G.; Gautheron, J. P.; Schrader, H. (Institut Max von Laue-Paul Langevin, 38-Grenoble (France)); Wollnik, H.; Fiedler, G.; Ewald, H. (Giessen Univ. (F.R. Germany)); Bocquet, J. P. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale). Phys. Lett.; 53B: No. 1, 45-47(11 Nov 1974).

The nuclear charge distribution of mass-separated monoenergetic fission products of the isobaric chains 90 and 91 were recorded with a ΔE Si-surface barrier detector. The achieved nuclear charge resolving power (fwhm) Z/ΔZ was 43. (auth)

15500 DEFORMATIONS AND MOMENTS OF INERTIA OF ACTINIDE NUCLEI IN THE GROUND AND SHAPE ISOMERIC STATES. Brack, M.; Ledergerber, T.; Pauli, H. C. (Institute for Theoretic Physics, Basel, Switzerland); Jensen, A. S. (Aarhus Univ. (Denmark)). Nucl. Phys.; 234A: No. 1, 185-215(25 Nov 1974).

By using a Woods-Saxon potential, equilibrium deformations are obtained by the Strutinsky shell-correction method. Deformation parameters β_2 and β_4 of the ground state and the shape isomeric state are extracted for all actinide nuclei. It is shown that the connection of β_2 and β_4 with the multipole moments Q_2 and Q_4 is not so trivial as sometimes assumed in the literature. The moments of inertia — taken at the same deformations — are evaluated within the cranking model. Their dependence on deformation and temperature (excitation energy) is discussed; the rigid-body values are demonstrated to be reached for both large deformations and large temperatures. Where available, experimental data are compared; the agreement is generally very good. (auth)

Nuclear Theory

Refer also to abstracts 15374, 15458, and 15493.

15501 (AAEC/E-315) STATISTICAL MODEL FOR COMPOUND NUCLEUS FORMATION. Cook, J. L. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Jul 1974. 10p. Dep. NTIS (US Sales Only) $4.00.

A simple statistical model for the process of forming a compound nucleus is related. It is found that the model predicts extremely small energy spreads for internal single-particle states. (auth)

15502 (BNL-tr-580) THEORY OF RADIATION WIDTH (HIGHLY EXCITED NUCLEI). Nosov, V. G.; Kamchatnov, A. M. Translated by S. J. Amoretty from Zh. Eksp. Teor. Fiz.; 67: No. 2, 441-452(1974). 26p. Dep. NTIS $4.50.

A microscopic theory of electromagnetic radiation by highly excited nuclei is developed on basis of the Landau theory of a Fermi fluid. Closed formulas for the mean radiative width and its mean square fluctuation from one level to another are obtained. Temperatures of various nuclei are calculated by using the observed widths. The relaxation time (for transition to an equilibrium state) is estimated by employing the experimental data on radiative width fluctuations. Regions of various types of relations between the relaxation time and lifetime of the compound nucleus are discussed as well as the relevant physical consequences. (auth)

15503 (CEA-CONF-2724) PREEQUILIBRIUM MODELS FOR NUCLEAR REACTIONS AND STUDIES INVOLVING NEUTRONS. Kalbach, C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire). [nd]. 43p. (CONF-740419-4). Dep. NTIS (US Sales Only) $5.25.

From 2nd international school on neutron physics; Alushta, USSR (2 Apr 1974).

The kinds of processes which the preequilibrium models try to explain are described, and the basic philosophies behind the cascade model, the Fermi-gas-equilibration model, the Griffin or exciton model, and the hybrid model are briefly set forth. Then the Griffin model is discussed in some detail: its description of the nuclear equilibration process, the empirical values for the model parameters as found from data analyses, and the utility of the model in describing data when systematic values for the parameters are chosen are considered. Finally, some of the unanswered questions with regard to this model are treated; these include the accuracy of the low-energy part of calculated preequilibrium spectra, the roles of the pairing and Coulomb forces in the initial stage of a reaction, and the importance of alpha clustering or quartet structures. The discussion is restricted to reactions with from 20 to 100 MeV excitation in the intermediate nucleus. (19 figures, 2 tables) (RWR)

15504 (COO-2130-119, pp 259-276) TRANSFER REACTIONS WITH HEAVY IONS. Robson, D. 1973.

In heavy ion lecture series. Volume I.

Inelastic scattering of heavy ions is treated briefly, as the theory is poorly developed. Transfer reactions are then treated in the framework of direct reaction theory; in particular, finite-range distorted-wave theory is used. Finally, the quartet situation (apparent alpha transfer in heavy-ion reactions) is discussed in relation to a large number of experiments. (8 figures) (RWR)

15505 (COO-3069-275) QUANTUM THEORY OF DISSIPATION FOR NUCLEAR COLLECTIVE MOTION. Kerman, A. K.; Koonin, S. E. (Massachusetts Inst. of Tech., Cambridge (USA)). 1974. Contract AT(11-1)-3069. 9p. (CONF-740646-5). Dep. NTIS $4.00.

From Nobel symposium on superheavy elements; Ronneby, Sweden (10 Jun 1974).

A theory of energy dissipation in heavy-ion and fission processes is presented. Beginning with the time-independent coupled-channels generator-coordinate equations, a statistical treatment leads to a quantal equation in the collective coordinates and excitation energy. Assumptions of adiabaticity lead to a momentum-coupled Schroedinger-like equation for the statistical wave function. This equation describes, in a statistical manner, quantum mechanical collective motion, including dissipation. Therefore, average inelastic cross sections or fragment excitation energies may be obtained. Of course, phenomenologically known functions such as the nuclear mass parameter or potential energy surface can be simply utilized. The new dissipation function (like all the others) is determined by averages of microscopically calculable quantities. Numerical results for a model calculation exhibiting the structure of the equation are presented. (2 figures) (auth)

15506 (FEI-424) PROJECTED BASIS FOR MULTIPHONON SYSTEMS IN COLLECTIVE NUCLEAR MODEL. Asherova, R. M.; Smirnov, Yu. F.; Tolstoi, V. N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1973. 18p. (In Russian). INIS.

The general method of projection operators was used for the construction of the basics of a multiphonon system in the collective model of the nucleus. The structure of the projected basics were studied, and its completeness and linear independence of the vectors was indicated. The matrix of the longitudinal motion integral was obtained. Its intrinsic values were not degenerate and could be used for the single-valued classification of multiphonon states. (tr-auth)

15507 (IFA-DNBR-12-1974) SLBWP (SINGLE LEVEL BREIT-WIGNER PROGRAM) FOR GENERATING EFFECTIVE CROSS SECTIONS IN THE RESOLVED RESONANCE REGIONS. Iliescu, N.; Benzi, V.; Menspace, E.; Motta, M. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 37p. (In Rumanian). Dep. NTIS (US Sales Only) $5.00.

The code is designed for the calculation of the neutron cross sections for elastic scattering, capture, fission and total, using Breit-Wigner approximation for a single level. Resonance-potential interference is considered, Doppler broadening and instrumental resolution broadening are optionally performed by successive numerical convolutions. The resonance integrals for a reaction, between the energy points considered, are calculated using lin-lin or log-log interpolations. The program permits the preparing of an energy grid connected with the degree of a accuracy. SLBWP is written in the FORTRAN IV language for the IAP Computer IBM 370/135. (auth)

15508 (IPNO-RC-73-09) LIMITATION TO COMPLETE FUSION DURING THE COLLISION BETWEEN TWO COMPLEX NUCLEI. Galin, J.; Guerreau, D.; Lefort, M.; Tarrago, X. (Paris-11 Univ., 91-Orsay (France). Inst. de Physique Nucleaire). 1973. 22p. Dep. NTIS (US Sales Only) $4.25.

Experimental results on the limits observed for complete fusion between heavy nuclei are discussed. It is shown that there is no critical angular momentum independent of the bombarding energy and of the entrance channel. Excitation energy and total angular momentum of the compound system do not appear as the good parameters for determining the complete fusion cross section. All the available results can be presented in terms of a critical distance of approach, $R_{(cr)}$. Such a distance is obtained when the kinetic energy of incoming nucleons equals the interaction potential, and is related to the nuclear matter density of both nuclei. For very heavy partners, a fusion barrier occurs, in addition to the interaction barrier. (auth)

15509 (IPNO/TH-73-39) ENERGY DENSITY FORMALISM AND THE SHELL STRUCTURE EFFECTS. Beiner, M.; Lombard, R. J. (Paris-11 Univ., 91-Orsay (France). Div. de Physique Theorique). Oct 1973. 79p. Dep. NTIS (US Sales Only) $7.00.

The Brueckner formulation of the energy density formalism was extended in order to take into account shell structure effects in the description of nuclear bulk properties. The energy density is calculated by using a density dependent effective interaction of the type $V_{eff} = g(\rho)\delta(r_1 - r_2) + V(l)(r_1 - r_2)$. The function $g(\rho)$ can be determined from nuclear matter calculations. The second term of the interaction is a long range part in the Moszkowski-Scott sense, which is supposed to contribute only in the surface of finite systems and for which use is made of the gradient expansion. A phenomenological l.s term is also included. The nuclear ground states are described by products of neutron and proton B.C.S. wave functions. The pairing matrix elements are derived from a realistic two-body interaction. The ground state properties are obtained by minimizing the total energy with respect to effective single particle orbitals and their corresponding occupation numbers. The variational principle leads to Hartree-Fock-BCS equations which can be solved by iterations. The calculations were performed for a very large number of nuclei distributed throughout the periodic table. The method is shown to reproduce the bulk nuclear properties accurately; binding energies and radii are in good agreement with experiments. The calculated charge distributions yield good fits to experimental elastic electron scattering data. Finally the single particle levels close to the Fermi surface are also consistent with experimental spectroscopic data. (auth)

15510 (LBL-2993) DYNAMICS OF VISCOUS NUCLEAR DROPS. Alonso, C. T. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Aug 1974. Contract W-7405-eng-48. 37p. (CONF-740837-3). Dep. NTIS $5.00.

From international colloquium on drops and bubbles; Pasadena, California, USA (28 Aug 1974).

A dynamical description of the oscillation, fission, and fusion of classical viscous charged or gravitating liquid drops is presented. This description is generated numerically by computer simulation. While the emphasis is on drops scaled to nuclear dimensions, the application is general. The methods described are applied to problems in astrophysics, meteorology, fluid mechanics, and space science. A preliminary survey is given of drop dynamics. Included is a discussion of the applicability of the classical hydrodynamic approach to the nuclear problem. This is followed by a description of the bulk flow equations and free surface boundary conditions for a viscous charged drop. Finally some simulations of the oscillations of charged and neutral drops as a function of initial shape, charge, and viscosity are presented. Also some preliminary simulations of fissions

and fusions of viscous charged drops are presented with some comments about the possible role of nuclear viscosity in the creation of "superheavy" elements in heavy ion accelerator experiments. (auth)

15511 (NIIAR-P-218) PROTON OCCUPATION NUMBERS OF THE MAGIC AND NEAR-MAGIC NUCLEI. Vinogradov, B. N. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1973. 12p. (In Russian). INIS.

The occupation numbers of proton levels, obtained for a series of magic and near-magic nuclei by the method in the configuration interaction on the basis of the multiparticle shell model with residual interaction in the form of δ force, were reported. (tr-auth)

15512 (RI-12) PROBABILITY OF THE LONG-RANGE PARTICLE EMISSION IN FISSION. Solov'eva, Z. I. (Radievyj Inst., Leningrad (USSR)). 1973. 3p. (In Russian). INIS.

An attempt is made to systematize, as a function of the mass number A presently available, the probability for the emission of long-range particles $W_\alpha(A)$ during fission. The values of W_α were given graphically for isotopes of U, Pu, Cf, Np, Cm, and Th. (INIS)

15513 (ZfK-245) NUCLEAR REACTION MODELS (REVIEW). Baldeweg, F. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Feb 1973. 32p. (In German). INIS.

This paper is a collection of the most important nuclear reaction models for light nuclei and low energies. A description is used which underlines the basic physical assumptions and the physical relations between the models. Special interest is directed to the different resonance reaction models. (auth)

15514 DERIVATION OF COLLECTIVE POTENTIALS AND MASS PARAMETERS FROM THE GENERATOR COORDINATE METHOD. Flocard, H.; Vautherin, D. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Phys. Lett., B; 52: No. 4, 399-400(28 Oct 1974).

By expanding the overlap and the hamiltonian kernels in the Hill–Wheeler equation into a series of hermitian differential operators, expressions for the collective potential and mass parameter are derived. (auth)

15515 DENSITY-DEPENDENT EFFECTIVE INTERACTIONS IN NUCLEI. Coon, S. A.; Koehler, H. S. (Arizona Univ., Tucson (USA). Dept. of Physics). Nucl. Phys., A; 231: No. 1, 95-114 (7 Oct 1974).

Effective interactions chosen to have the same structure as the Brueckner reaction matrix were used in self-consistent field calculations on some closed shell nuclei. These finite range interactions are velocity-dependent and depend on the starting energy. The density dependence and starting energy dependence were determined by fitting the diagonal K-matrix elements of nuclear matter which were calculated with the Reid soft-core potential. Two interactions were derived: $U_p = 0$ from a K-matrix defined with a pure kinetic energy particle spectrum and $U_p \neq 0$ from a K-matrix with a self-consistent insertion in particle states just above the Fermi surface. The model $U_p \neq 0$ was also modified by changing the size of the correlation wound integral which determines the starting energy dependence. It was found that the removal of that part of the wound integral which is due to the repulsive core of the nucleon-nucleon interaction resulted in the best single-particle spectrum. (auth)

15516 MICROSCOPIC THEORY OF PARTICLE-VIBRATION COUPLING. Corbett, J. O. (Oxford Univ. (UK). Dept. of Theoretical Physics). Nucl. Phys., A; 233: No. 1, 133-144(11 Nov 1974).

A microscopic theory of the coupling between collective vibrations and independent-particle excitations is developed, in which generator coordinates are used in order to describe the collective modes. Formulas for the coupling are derived and compared with the standard theory. The method applies to any Hamiltonian with two-body interactions that has a stable Hartree-Fock solution. It is found that the strength of some of the coupling terms depends on energy, and that second-order coupling, which does not figure in the standard treatment, can be important. (auth)

15517 THE EFFECT OF THE GAUGE-INVARIANT PAIRING INTERACTION ON THE PROPERTIES OF DEFORMED NUCLEI. Hamamoto, I. (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)). Nucl. Phys., A; 232: No. 2, 445-464(4 Nov 1974).

The effect of the gauge-invariant form of the pairing interaction on the following properties of deformed nuclei is investigated: A new contribution to moments of inertia (the Migdal term) of both doubly even and odd-A nuclei. The reduction of Coriolis coupling strength, which depends on particle orbits. The properties of the $K^\pi = 1^+$ intrinsic excitations which have a close relation to the rotational degree of freedom. (auth)

15518 ONE-BOSON-EXCHANGE POTENTIAL AND EFFECTIVE INTERACTION. Machleidt, R.; Erkelenz, K.; Holinde, K. (Bonn Univ. (F.R. Germany). Inst. fuer Theoretische Kernphysik). Nucl. Phys., A; 232: No. 2, 398-416(4 Nov 1974).

Two one-boson-exchange potentials (OBEP) previously constructed are employed for deriving density-dependent local effective interaction potentials for use in finite nuclei. The definition of the effective interaction is based on nuclear matter Brueckner theory and is equivalent to that given by Siemens. The mathematical formalism and numerical methods, however, are different from former work, as most of the calculations take place in the momentum space, where the OBEP are given. The resulting effective interactions are compared to that based on the Reid soft-core potential. The density dependence of the different effective interactions is demonstrated over a vast range. (auth)

15519 GENERALIZED NUCLEAR POLARIZABILITIES IN (e,e'γ) COINCIDENCE METHODS. Arenhoevel, H.; Drechsel, D. (Mainz Univ. (F. R. Germany). Inst. fuer Kernphysik). Nucl. Phys., A; 233: No. 1, 153-163(11 Nov 1974).

The (e,e'γ) coincidence cross section is expressed in terms of the nuclear polarizabilities as a generalization of the standard (γ,γ') formalism for polarized photons. This formalism is well suited to determine nuclear spins in a model-independent way. Due to the presence of virtual photons of longitudinal and transverse polarization and variable momentum transfer, electroexcitation gives more complete information than scattering of real photons and allows one to study the polarizabilities as function of excitation energy and momentum transfer. (auth)

15520 STRIPPING TO ANALOG RESONANCES. Bund, G. W. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). Nucl. Phys., A; 233: No. 1, 217-229(11 Nov 1974).

Stripping to analog resonances is studied by expressing the DWBA cross section in terms of the resolvent operator appropriate to the system composed of the proton and the target. The resolvent operator is decomposed, by means of the Feshbach projection operator technique, into parts corresponding to the entrance channel, the analog state and the compound states. The approximation scheme is similar to that used in a previous treatment of proton scattering at an analog resonance. The complex proton form factor depends on the Green function satisfying the inhomogeneous Schrödinger equation corresponding to elastic scattering and on the Coulomb potential generated by the target. The method is applied to (^{3}He,d) stripping to analogs in ^{93,95,97}Tc. (auth)

15521 HEAVY ION INDUCED TRANSFER REACTIONS LEADING TO WEAKLY BOUND FINAL STATES. Nagarajan, M. A. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Phys. Lett., B; 52: No. 4, 395-398(28 Oct 1974).

A simple model is suggested for the study of heavy-ion-induced transfer reactions leading to weakly bound (or unbound) final states. The finite-range and recoil effects are considered, and a simple expression is obtained for the differential cross section at high energies. (auth)

15522 A TWO-STEP MODEL OF PION INDUCED NUCLEON KNOCKOUT REACTIONS. Strobel, G. L. (Georgia Univ., Athens (USA). Dept. of Physics). Nucl. Phys., A; 232: No. 2, 502-510 (4 Nov 1974).

A two-step model is utilized to explain the puzzling isospin dependence of pion induced nucleon knockout reactions. The model treats the pions as strongly absorbed by nuclei. The pion is assumed to interact only once, even in the two-step mechanism. Energy transfer systematics suggest the pion interaction is with a four-nucleon cluster. If so, this helps to explain the surprisingly large pion induced α-knockout cross sections seen recently. (auth)

15523 HEAVY-ION SCATTERING AT INTERMEDIATE AND HIGH ENERGIES. Donnelly, T. W.; Dubach, J.; Walecka, J. D. (Stanford Univ., Calif. (USA). Inst. of Theoretical Physics). Nucl. Phys., A; 232: No. 2, 355-380(4 Nov 1974).

The elastic scattering of two heavy ions is investigated. Elastic scattering gives information on the heavy-ion optical potential and forms a basis for a further description of heavy-ion reactions using either the DWBA or the semi-classical approach to these processes. To extract the nuclear parameters from elastic scattering, one can use an exact phase-shift analysis, which at high energies is tedious and difficult (the Coulomb barrier sets the energy scale), or one can use various approximation schemes to compute the phase shifts. The validity of the WKB approximation and its high energy eikonal limit (the "Glauber approximation") is investigated. The high energy limit has the advantage

that it is very simple and gives a useful picture of the scattering process in terms of straight-line eikonal trajectories. The systematic V/E corrections to the high energy phase shift are considered. The exact scattering amplitude is compared with the various approximations to it for an optical potential which fits $^{58}Ni(^{16}O, ^{16}O)^{58}Ni$ at low energies. The simple high energy approximation is shown to provide an accurate description of the scattering process at energies and scattering angles of practical interest. Some analytical expressions are given for the heavy-ion scattering amplitudes in the high energy approximation, and the model problem of heavy-ion scattering by a totally absorbing black sphere is also discussed. (auth)

15524 STUDY OF THE GROUND-STATE CORRELATIONS AND CONTINUUM MODEL CALCULATIONS FOR PHOTONUCLEAR REACTIONS. Do Dang, G. (Paris-11 Univ., 91 - Orsay (France). Lab. de Physique Theorique et Hautes Energies); Ramavataram, K.; Ramavataram, S. (Laval Univ., Quebec City (Canada). Dept. de Physique). Nucl. Phys., A; 231: No. 3, 376-390(21 Oct 1974).

By using the effective operator formalism, the importance of ground-state correlations on photonuclear cross sections is studied. For purposes of orientation, a bound-state calculation is first performed to take into account the mixing of 2p−2h and 3p−3h configurations into the 1p−1h dipole states. Inclusion of these configurations is found to affect the energies of the 1p−1h states in opposite directions and the combined effect, including that on the transition strengths, is negligible. Most of the reduction in the absorption comes from the ground-state correlations of which the A dependence is examined with a model interaction. The excitation function is then calculated for the reactions by using effective dipole matrix elements obtained from the continuum wave functions of the coupled-channels calculation. Application to the case of ^{16}O leads to a reduction of about 25% in the cross sections. (auth)

15525 EFFECT OF THE DIFFUSED CHARGE DISTRIBUTION IN THE ANALYSIS OF β-DECAYS. Asai, J.; Ogata, H. (Windsor Univ., Ontario (Canada). Dept. of Physics). Nucl. Phys., A; 233: No. 1, 55-62(11 Nov 1974).

The uniform charge distribution inside a nucleus is re-examined by using a diffused charge distribution, which reduces to the uniform charge distribution when the thickness is taken to be zero. Electron radial wave functions and ft values of superallowed Fermi transitions are discussed in terms of these two different charge distributions. (auth)

15526 QUENCHING OF AXIAL-VECTOR COUPLING CONSTANT IN β-DECAY AND PION-NUCLEUS OPTICAL POTENTIAL. Rho, M. (State Univ. of New York, Stony Brook (USA). Dept. of Physics). Nucl. Phys., A; 231: No. 3, 493-503(21 Oct 1974).

A very simple description of the quenching in nuclear matter of the axial-vector coupling constant in β decay is given in terms of the model of Barshay, Brown and Rho, constructed to provide a microscopic picture to the pion−nucleus optical potential for π-mesic atoms. The connection between the two quantities suggests a plausible test of the Lorentz−Lorenz non-linear effect in π−nucleus scattering. By comparing with the sum rule estimate made by M. Ericson, it is found that the quenching of g_A is consistent with an essentially unsuppressed Lorentz−Lorenz term in the optical potential. (auth)

15527 FRAGMENT STIFFNESS-PARAMETERS C_γ AT SCISSION. Schultheis, H.; Schultheis, R. (Tuebingen Univ. (F. R. Germany). Inst. fuer Theoretische Physik). Phys. Lett., B; 52: No. 4, 389-391(28 Oct 1974).

The fragment deformation β at scission and the stiffness parameters C_γ are calculated for the fission of ^{236}U and ^{252}Cf. The results show that in both compound nuclei the stability against axial asymmetric deformations is determined by fragment shell effects in the β-values. (auth)

15528 A CASCADE-EVAPORATION MODEL FOR PHOTONUCLEAR REACTIONS. Barashenkov, V. S.; Gereghi, F. G.; Iljinov, A. S.; Jonsson, G. G.; Toneev, V. D. (Joint Inst. for Nuclear Research, Dubna (USSR)). Nucl. Phys., A; 231: No. 3, 462-476(21 Oct 1974).

Detailed and systematic Monte Carlo calculations have been performed for different characteristics of inelastic photonuclear reactions for an energy range of $T_\gamma \sim 50$ MeV−1 GeV in the framework of the intranuclear cascade model with the competition between particle evaporation and fission of excited residual nuclei taken into account. The calculated results agree well with experimental data. On the basis of the data listed it is possible to extrapolate the corresponding characteristics for intermediate energies and nuclei. (auth)

15529 THE ROLE OF OFF-SHELL SCATTERING IN THE PION OPTICAL POTENTIAL. Landau, R. H. (British Columbia Univ., Vancouver (Canada). Dept. of Physics); Tabakin, F. (Pittsburgh Univ., Pa. (USA). Dept. of Physics). Nucl. Phys., A; 231: No. 3, 445-454(21 Oct 1974).

A discussion of the expected and calculated importance of the off-energy shell πN interaction as it is used to construct a pi−nucleus optical potential is presented. Simple coordinate-space and equivalent momentum-space descriptions of the multiple scattering process are employed, as well as numerical studies including recently developed πN models. It is demonstrated that, by incorporating the inherent short-but-nonzero-range aspects of the πN interaction into the nuclear scattering theory, the off-shell sensitivity will be slight even without the introduction of fixed nucleons or nucleon−nucleon correlations which keep the nucleons apart. Several of the popular pi−nucleus theories are consequently found to be physically unacceptable. (auth)

15530 NUCLEAR CHARGE-ASYMMETRY EFFECTS FROM ISOTENSOR CURRENTS. Chemtob, M.; Furui, S. (CEA Centre d'Etudes Nucleaires de Saclay, 91−Gif-sur-Yvette (France). Service de Physique Theorique). Nucl. Phys., A; 233: No. 2, 435-455(18 Nov 1974).

Departures from mirror symmetry in γ and β decays of nuclear states are investigated by postulating the existence of isotensor components in electromagnetic and weak currents of hadrons. Their effects are described by means of two-body exchange current operators. These are found to exhibit simple properties which enable one to set useful bounds on the isotensor admixture. The consideration of resonance-exchange contributions in the processes γ (or β) + N → π + N suggests the N → Δ transition current as the most favorable candidate. A numerical application to M1 and Gamow−Teller transitions of the isoquartet of states in the isobars A = 13 (B,C,N,O) is discussed. It is found that the test is reasonably model-independent but very insensitive. Therefore, low-energy phenomena may be not too promising. Results are also given for other isoquartets in the p shell. (auth)

15531 SELF-CONSISTENT SYMMETRIES OF THE HARTREE-FOCK-BOGOLIUBOV EQUATIONS IN A ROTATING FRAME. Goodman, A. L. (Carnegie-Mellon Univ., Pittsburgh, Pa. (USA)). Nucl. Phys., A; 230: No. 3, 466-476(30 Sep 1974).

The self-consistent symmetries σ_x (reflection through the yz plane) and $TR_z(\pi)$ and their eigenfunctions are employed to reduce the dimension of the Hartree−Fock−Bogoliubov equations in a rotating frame by a factor of two. In the canonical or BCS representation, σ_x maps each single-particle orbital into itself. (auth)

15532 COMPARISON OF POTENTIAL-ENERGY SURFACES AND MOMENTS OF INERTIA WITH EXPERIMENTAL SPECTROSCOPIC TRENDS FOR NON-SPHERICAL Z = 50-82 NUCLEI. Ragnarsson, I. (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)); Sobiczewski, A.; Nerlo-Pomorska, B. (Institute of Nuclear Research, Warsaw (Poland)); Sheline, R. K. (Florida State Univ., Tallahassee (USA)); Larsson, S. E. (Tekniska Hoegskolan, Lund (Sweden). Institutionen foer Matematisk Fysik). Nucl. Phys., A; 233: No. 2, 329-356(18 Nov 1974).

A broad discussion of the ground-state potential-energy surfaces of doubly even deformed and transitional nuclei with Z = 50−82 is presented. The surfaces are calculated microscopically as functions of the quadrupole axial ϵ and non-axial γ and the axial hexadecapole ϵ_4 deformations. A correlation between the form of the surfaces and the experimental spectroscopic trends is extensively discussed. Comparisons are made with the experimental data including the ground-state band 2^+, 4^+ and 6^+ energy levels, the quasi-gamma band heads, $2'^+$, and the quasi-beta band heads, $0'^+$. Some general correlation is found although for more detailed comparisons a need of dynamics becomes evident. In addition, the electric quadrupole moments and moments of inertia of the nuclei are discussed. (auth)

15533 COMPARISON OF MICROSCOPIC CALCULATIONS OF SOLID NEUTRON STAR MATTER. Canuto, V.; Lodenquai, J. (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)); Chitre, S. M. (Tata Inst. of Fundamental Research, Bombay (India)). Nucl. Phys., A; 233: No. 2, 521-528(18 Nov 1974).

At the Urbana Workshop on "dense neutron matter" it was agreed that each group involved should check the many-body techniques so far employed on a test problem, outlined by H. A. Bethe. This paper reports the results using the t-matrix and variational approaches. Satisfactory agreement is obtained. Comparison with the results of other groups is discussed. (auth)

15534 IS THE MADISON CONVENTION REALLY CONVENIENT AT LOW ENERGIES? The Reaction $^6Li(\vec{\alpha},\alpha)^4He$ at 400 keV. Lindner, A.; Ebinghaus, H. (Hamburg Univ. (F. R.

Germany). 1. Inst. fuer Experimentalphysik). Nucl. Phys., A; 230: No. 3, 487-489(30 Sep 1974).

It is shown that s-wave induced reactions with polarized particles can be described much more conveniently in new coordinates. Even with higher partial waves, cross sections can be fitted with fewer parameters than in conventional expansions. (auth)

15535 TRIPLE CORRELATION FUNCTIONS FOR DESCRIBING THREE-BODY REACTIONS AND POLARIZATION EXPERIMENTS. Lindner, A. (Hamburg Univ. (F. R. Germany). 1. Inst. fuer Theoretische Physik). Nucl. Phys., A; 230: No. 3, 477-486(30 Sep 1974).

The triple correlation functions $P_{n_0 n_1 n_2}(\Omega_0,\Omega_1,\Omega_2)$ form a rotational invariant basis for all experiments depending on three directions. Their usefulness for the description of three-body reactions and polarization experiments is demonstrated. In the latter case the sum $n_0 = n_1 + n_2$ may be odd, pertaining to the well-known right-left asymmetries. Numerical methods are given to calculate these functions and the relevant expansion coefficients. The directions are tabulated which are best suited for experiments. (auth)

15536 COMPACT REFORMULATION OF DISTORTED-WAVE AND COUPLED-CHANNEL BORN APPROXIMATIONS FOR TRANSFER REACTIONS BETWEEN NUCLEI. Tamura, T. (Texas Univ., Austin (USA). Center for Nuclear Studies). Phys. Rep.; 14: No. 2, 59-96(Nov 1974).

DWBA and CCBA calculations are reformulated in a form which is compact, and which is symmetric with respect to the projectile-ejectile system and to the target-residual nucleus system, so that the formulas can be used conveniently for heavy-ion as well as light-ion induced reactions. Clarification is also made of the relation between the exact finite-range calculations on the one hand and the no-recoil and zero-range approximations on the other. Some detailed information is given to show how to carry out efficiently the exact finite-range calculations. (auth)

15537 MICROSCOPIC R-MATRIX THEORY IN A GENERATOR COORDINATE BASIS. I. Theory and Application to Dineutron-Dineutron and $\alpha-\alpha$ Scattering. Baye, D.; Heenen, P. H. (Brussels Univ. (Belgium)). Nucl. Phys., A; 233: No. 2, 304-316 (18 Nov 1974).

A new method is presented to treat the scattering of composite particles by the generator coordinate method. The treatment is an improvement of the one proposed by Horiuchi. More elaborate connection techniques are used based on a completely anti-symmetrized R-matrix theory. The results are in very good agreement with those obtained by the other generator coordinate methods, but a much smaller number of discretization points are needed to solve the Hill-Wheeler equation. Results obtained by Horiuchi's approximation are also presented. They strongly depend on the radius of the internal region and unphysical resonances appear at higher energies. These problems have been eliminated in this treatment. (auth)

15538 VALIDITY OF A MODIFIED-RADIUS BORN APPROXIMATION TO REPLACE CCBA CALCULATIONS. Udagawa, T.; Tamura, T. (Texas Univ., Austin (USA). Center for Nuclear Studies). Nucl. Phys., A; 233: No. 2, 297-303(18 Nov 1974).

It is shown that under favorable conditions CCBA calculations can be replaced by ordinary DWBA calculations in which the radius parameters of the optical potentials are appropriately modified. (auth)

15539 ENERGY SURFACES, COLLECTIVE POTENTIALS AND COLLECTIVE INERTIA PARAMETERS. Giraud, B.; Grammaticos, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Service de Physique Theorique). Nucl. Phys., A; 233: No. 2, 373-384(18 Nov 1974).

The Hill-Wheeler equation is used to derive a collective Hamiltonian from an energy surface. Two simple ansatze are proposed for the collective Hamiltonian, which is then calculated explicitly in a hierarchy of approximations. The consistency of the method is verified in an illustrative example. (auth)

15540 MULTIPARTICLE-MULTIHOLE CONFIGURATIONS AND PHOTONUCLEON ENERGY SPECTRA FOR INTERMEDIATE AND HEAVY NUCLEI. Zhivopistsev, F. A.; Lukashev, A. V.; Shitikova, K. V. Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 4, 822-824(Apr 1974). (In Russian).

From 23rd annual conference on nuclear spectroscopy and nuclear structure; Tbilisi, USSR (29 Jan 1973). For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

The form of the energy spectra of photonucleons was studied in the framework of the shell model with consideration of the admixtures of the multiparticle-multihole configurations. (tr-auth)

15541 EVIDENCE OF TWO PHASE TRANSITIONS IN NUCLEAR YRAST STATES. Sood, P. C. (Banaras Hindu Univ., India). Progr. Theor. Phys. (Kyoto); 51: No. 5, 1613-1615(May 1974).

Evidence is presented in favor of the Mottelson-Valatin type phase transitions. The transitions of cerium-132 are found to show a double-hump pattern favoring this concept. It is concluded that the double-hump characteristic occurs for yrast states in all nuclei based on the consideration that the two humps correspond to the two phase transitions. (JFP)

15542 NUCLEAR-STRUCTURE THEORY IN RELATIVE COORDINATES. Miglietta, F. (Univ., Pavia, Italy). Lett. Nuovo Cim.; 11: No. 11, 537-540(16 Nov 1974).

In the description in relative coordinates of a nucleus a basis of N-particle functions which are eigenfunctions of a model Hamiltonian which describes the relative motion of N particles interacting through harmonic forces and given Jacobi relative coordinates is assumed. It is noted that the calculation $\langle N|N-1\rangle$ fractional parentage coefficients by a given equation or by other methods appears of fundamental importance for allowing a treatment of light nuclei free from troubles due to the center of mass motion. (JFP)

15543 STRUCTURE OF THE ATOMIC NUCLEUS. Isabelle, D. (Clermont-Ferrand Univ., France); Ripka, G. Recherche (Paris); 5: No. 46, 543-551(Jun 1974). (In French).

The successive introduction of the various nuclear structure theories is discussed: the nuclear force concept, the shell model and the collective model, the properties of the deformed nuclei displaying the relation between the shell model and the collective nuclear models. (auth)

15544 TWO-PION EXCHANGE IN THE NUCLEON-NUCLEON POTENTIAL. Bohannon, G. E. (Michigan State Univ., East Lansing (USA). Dept. of Physics). Phys. Lett.; 53B: No. 1, 11-14(11 Nov 1974).

The two-pion-exchange potential is calculated using experimental $\pi\pi$, πN and eN information and compared with the Hamada-Johnston and deTourreil-Sprung phenomenological potentials. The calculated potential is found to be in very satisfactory agreement with the phenomenological values at radii greater than 1.2 to 1.5 fm except in the isospin-zero spin-orbit case. The potential is somewhat sensitive to the low-energy I = J = 0 $\pi\pi$ interaction, which is still experimentally uncertain. (auth)

15545 THE FRAGMENTATION OF THE GIANT DIPOLE RESONANCE IN THE SCHEMATIC MODEL. Vergados, J. D. (Pennsylvania Univ., Philadelphia (USA). Dept. of Physics). Phys. Lett.; 53B: No. 2, 151-154(25 Nov 1974).

Brown's schematic model of the giant dipole resonance is generalized in the case of nonclosed shell nuclei. Many collective dipole states are predicted with a given spin, parity and isospin. This explains the fragmentation of the GDR of nonclosed shell nuclei. (auth)

15546 TEST OF CRANKING PLUS RPA ON AN EXACTLY SOLUBLE BACKBENDING MODEL. Bose, S.; Krumlinde, J.; Marshalek, E. R. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Phys. Lett.; 53B: No. 2, 136-140(25 Nov 1974).

Self-consistent cranking with additional RPA correlations is tested on the exactly soluble R(5) model of Krumlinde and Szymanski. Excellent agreement between approximate and exact solutions is obtained excepting a couple of points very near the critical spin. (auth)

15547 TWO-CENTRE HARTREE-FOCK PROBLEMS. Dreizler, R. M.; Galbraith, H.; Lin, L. (Frankfurt Univ. (F.R. Germany). Inst. fuer Theoretische Physik). Nucl. Phys.; 234A: No. 1, 253-268(25 Nov 1974).

Explorative Hartree-Fock calculations based on the two-centre oscillator Hamiltonian with a contact-type residual force are carried out for the light systems ^{8}Be $\longleftrightarrow$ 2 ^{4}He and ^{24}Mg $\longleftrightarrow$ 2 ^{12}C. Preliminary contact with experiment is made for the HF ground-state energies after correction for Coulomb and c.m. fluctuation effects. The single-particle spectra of the combined systems, which occur for a centre separation of 3.6 fm (^{8}Be) and 2.8 fm (^{24}Mg) are compared to one-centre results. (auth)

15548 ON ROTATIONAL BAND CROSSING IN DEFORMED NUCLEI. Pavlichenkov, I. M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). Phys. Lett.; 53B: No. 1, 35-38(11 Nov 1974).

Crossing of the rotational bands of various types in deformed nuclei was analyzed. The backbending area in the lower band was determined and the interband-to intraband B(E2) ratios were calculated. (auth)

15549 LEVEL REPULSION IN THE GROUND-STATE REGION OF NUCLEI. Cota, E.; Flores, J. (Universidad Nacional Auton-

oma de Mexico, Mexico City); Mello, P. A.; Yepez, E. (Instituto Politecnico Nacional, Mexico City. Escuela Superior de Fisica y Matematicas). Phys. Lett.; 53B: No. 1, 32-34(11 Nov 1974).

By using the nuclei in the nuclear table as members of an ensemble of hamiltonians, it is shown that, once nuclei with a systematic behaviour are eliminated, the nearest-neighbour spacings between states with the same spin and parity follow, in the ground-state region, a distribution which is roughly consistent with that predicted by the gaussian orthogonal ensemble (GOE). There is some indication, which however is not conclusive, that the two-body random hamiltonian ensemble fits the data somewhat better than the GOE. (auth)

15550 ON A SIMPLIFIED EFFECTIVE NEUTRON–PROTON INTERACTION INCLUDING CORE-POLARIZATION EFFECTS FOR ODD–ODD DEFORMED NUCLEI. Boisson, J. P.; Ogle, W.; Piepenbring, R. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Phys. Lett.; 53B: No. 1, 25-26(11 Nov 1974).

It is well known that the description of odd–odd deformed nuclei is not satisfactory if the usual one-parameter δ force is used as the residual neutron–proton interaction. In this letter it is shown that, starting with a simple δ force, an improvement can be obtained which takes into account polarization effects of the core, as well as possible tensor and spin–orbit force effects, and which introduces only one additional parameter. This improvement is even better than that obtained with a finite range central-plus-tensor force, which introduces four additional parameters. (auth)

15551 SPLASHING OUT—A POSSIBLE MECHANISM OF PREEQUILIBRIUM EMISSION. Belyaev, S. T.; Rumyantsev, B. A. (AN SSSR, Novosibirsk. Inst. Yaderno] Fiziki). Phys. Lett.; 53B: No. 1, 6-8(11 Nov 1974).

A dynamical model of preequilibrium emission is suggested which predicts and enables one to calculate the correlation effects, e.g. the angular anisotropy with forward–backward symmetry, the energy—and angular—correlations of secondaries in the (n,2n) reaction. (auth)

15552 ON ABSOLUTE CROSS SECTIONS FOR TWO-PARTICLE TRANSFER BETWEEN HEAVY IONS. Bang, J.; Dasso, C. H.; Gareev, F. A.; Nilsson, B. S. (Niels Bohr Institutet, Copenhagen (Denmark)). Phys. Lett.; 53B: No. 2, 143-146(25 Nov 1974).

Ground state wave functions for systems of two particles outside an inert core are calculated by diagonalizing a delta interaction in a Sturmian basis. The wave functions are used in calculations of cross sections for two-particle transfer reactions between heavy ions. The magnitude of the cross section is shown to depend strongly on the number of components of the basis included to describe the overlap. (auth)

15553 A REMARK ON AVERAGE SEPARATION ENERGIES AND WIDTHS OBTAINED FROM KNOCK-OUT REACTIONS. Berggren, T. (Lund Univ. (Sweden)). Phys. Lett.; 53B: No. 2, 163-164(25 Nov 1974).

A formulation in terms of overlap integrals (or single nucleon form factors) is given as a translation-invariant alternative to that of Koltun for the average separation energies and widths observed in knock-out reactions. (auth)

15554 "GAUGE-SPIN" MODEL OF PAIRING COLLECTIVE MOTION. Chen, H. T.; Cohenca, J. M.; Hussein, M. S. (Sao Paulo Univ. (Brazil). Instituto de Fisica). Phys. Lett.; 53B: No. 2, 158-162(25 Nov 1974).

A new microscopic model of pairing collective motion described mathematically by the group $SU(2) \times SU(3)$ is proposed. The concept of "gauge-spin" is introduced through which a set of "heavy-spin" is introduced through which a set of heavy-ion reaction experiments is suggested. (auth)

15555 A NEW SEMI-CLASSICAL THEORY FOR MULTIPLE COULOMB EXCITATION. Levit, S.; Smilansky, U. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics); Pelte, D. (Heidelberg Univ. (F.R. Germany). 1. Physikalisches Inst.). Phys. Lett.; 53B: No. 1, 39-44(11 Nov 1974).

A uniform semi-classical approach based on the classical limit of Feynman's path-integral representation is applied for the case of multiple Coulomb excitation. The resulting excitation probabilities are compared with those obtained from the conventional semi-classical treatment and also with the results of the full quantum mechanical coupled channels treatment. (auth)

15556 A RESOLUTION OF SOME ORTHOGONALITY AND EXPANSION-SET PROBLEMS IN MANY-BODY SCATTERING THEORY. Kouri, D. J. (Max-Planck-Institut fuer Stroemungsforschung, Goettingen (F.R. Germany)); Levin, F. S. (Brown Univ., Providence, R. I. (USA). Dept. of Physics). Phys. Lett.; 53B: No. 1, 27-31(11 Nov 1974).

A modification to the coupled channel equations for many-body scattering is introduced, based on the evaluation of the discontinuity equation for the matrix of transition operators. The resulting (modified) equations are shown to be in a form which resolves some problems associated with continuum states in an analysis of rearrangement collisions using the eigenstate expansion method. (auth)

15557 WEIZMANN SHELL MODEL COMPUTATIONAL CODE. Gross, R.; Accad, Y. (Weizmann Inst. of Science, Rehovoth (Israel)). Comput. Phys. Commun.; 8: No. 2, 101-117(Sep 1974).

WSMCC is a computer program which carries out nuclear shell-model (spectroscopy) calculations. Given the total number of particles, total angular momentum and total isospin, the program calculates the energy levels and eigenstates as functions of the two-body matrix elements and the single-particle energies. Calculations are carried out by reducing the problem to the two-body matrix elements, by using the well-known shell-model formalism. The current version of the program can handle large configurations as well as small ones, and it is able to calculate any matrix element of a two-body scalar operator in one, two or three shells. For more than three shells, the program can be extended by recoupling the angular momenta of the n particles in the wave function so that all unchanged (n-2) particles will be coupled together (this extension is available, but is not included in the current version). (auth)

15558 PIRK: A COMPUTER PROGRAM TO CALCULATE THE ELASTIC SCATTERING OF PIONS FROM NUCLEI. Eisenstein, R. A.; Miller, G. A. (Carnegie-Mellon Univ., Pittsburgh, Pa. (USA). Dept. of Physics). Comput. Phys. Commun.; 8: No. 2, 130-140(Sep 1974).

Angular distributions for the elastic scattering of pions from optical potential representations of the nucleus are generated from the partial-wave expansion of the scattering amplitude. Complex phase shifts for each partial wave are obtained by numerically integrating the radial Klein–Gordon equation in the interior region and matching to the asymptotic Coulomb wavefunction in the exterior region. The integration is done using the fourth-order Runge–Kutta method. To insure accuracy, the program utilizes double precision arithmetic. Several optical potentials and nuclear densities are available in the program. (auth)

15559 PROJECTED QUASIPARTICLE CALCULATIONS IN LARGE MODEL SPACES. Allaart, K.; van Gunsteren, W. F. (Vrije Universiteit, Amsterdam (Netherlands). Natuurkundig Lab.). Nucl. Phys.; 234A: No. 1, 53-60(25 Nov 1974).

A general formalism is presented, by means of which number-projected BCS quasi-particle calculations require only a little more computational effort than unprojected ones, even in large model spaces. It is a generalized and improved combination of known formalisms. Its advantages over those methods are discussed. The formalism is very well suited for applications where the BCS superfluidity parameters are different for initial and final states, such as particle-transfer reactions and pairing vibrations. Extensive formulas are given. (auth)

PHYSICS (RADIATION AND SHIELDING)

Radiation Physics

Refer also to abstracts 14672 and 15349.

15560 (AD-783312) BETA-II, A TIME-DEPENDENT, GENERALIZED-GEOMETRY MONTE CARLO PROGRAM FOR BREMSSTRAHLUNG AND ELECTRON TRANSPORT ANALYSIS. Volume II. User's Manual. Report for 15 October 1970–9 October 1971. Jordan, T. M. (A. R. T. Research Corp., Los Angeles, Calif. (USA)). 29 Oct 1971. Contract F29601-72-C-0013. 286p. (ART-60-VOL-2). NTIS $17.50.

A description of the BETA-2 program for Monte Carlo calculation of electron and photon transport in complex geometries is presented. The program description includes a user's manual describing the preparation of input data cards, the printout from a sample problem including the data card images, definitions of Fortran variables, the program logic, and the control cards required to run on the CDC 6600, IBM 360, UNIVAC 1108, and IBM 7094 computers. (auth)

15561 (INT-30/I) ABSORPTION OF THE GAMMA RADIATION IN INHOMOGENEOUS MEDIA. Gyurcsak, J.; Uriastowski, K. (Akademia Gorniczo-Hutnicza, Krakow (Poland). Instytut Metalurgii). Nov 1972. 65p. INIS.

The results of the Monte-Carlo calculations carried out in order to investigate gamma-ray absorption in inhomogeneous media are presented. Modeled inhomogeneous media were composed of spherically shaped grains randomly distributed in a continuous medium being the matrix. The calculations were done for Fe_3O_4 in water and $BaSO_4$ in H_3BO_3 mixtures. The photons energies were 22.6 keV, 41.4 keV and 60 keV. The influence of the grain size and concentration of the admixture as well as the influence of the photons energy and sample thickness, on the absorption of gamma radiation were examined. An unexponential dependence of the gamma radiation attenuation on the absorber thickness was obtained. (auth)

15562 (RD/B/N-2776) SCORING AND ANALYSIS OF RESULTS IN THE MONTE CARLO PARTICLE TRANSPORT CODE SPARTAN. SPARTAN Development Report 1. Bending, R. C.; Easter, P. G.; Parkes, G. E. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Mar 1974. 49p. Dep. NTIS (US Sales Only) $5.50.

Methods used to score and analyze results in SPARTAN, a general purpose Monte Carlo transport code developed at Berkeley Nuclear Laboratories are described. The estimators used to score physical quantities such as neutron flux are described, and methods are presented for the detection of non-normality in samples and the estimation of confidence intervals. Two methods of calculating the reactivity of a system in which neutron-induced fission occurs are included. The report gives details of the implementation of these methods in SPARTAN. (UK)

15563 RANGE AND MULTIPLE-SCATTERING MEASUREMENTS OF LOW-ENERGY MUONS. Lagerlund, T. D.; Blecher, M.; Gotow, K.; Keller, R.; Lam, W. C. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). Nucl. Instrum. Methods; 120: No. 3, 521-524(15 Sep 1974).

The range and multiple scattering of muons of kinetic energies between 9 and 25 MeV from foils of steel, aluminum, and polyethylene have been measured simultaneously. The root-mean-square projected angle is expressed, after Moliere, as $\theta_{proj}^{rms} = A(L/L_{rad})^{1/2}\, 15(p\nu)^{-1}$, where L is the foil thickness, L_{rad}, the foil radiation length, p, the muon momentum in MeV/c, and ν, the muon velocity in units of c. In this energy range it is found that $A = 1.09 \pm 0.02$. (auth)

15564 ANGULAR AND ENERGY DISTRIBUTIONS OF HEAVY NONRELATIVISTIC PARTICLES IN A SLAB ABSORBER AT DEEP PENETRATIONS. Remizovich, V. S. Sov. At. Energy (Engl. Transl.); 36: No. 5, 499-500(May 1974).

Translated from At. Energ.; 36: No. 5, 394-395(May 1974).

For the case of a broad beam of fast, heavy, nonrelativistic particles incident normally on a thick absorber, the angle of deflection remains small for penetrations up to nearly half the range, but the energy of the particles is appreciably changed. At great depths, therefore, it is impossible to neglect the effect of energy degradation and the fluctuations in energy losses on the angular distribution. In this case the angle and energy variables in the transport equation are not separable since the coefficients in the equation depend strongly on the particle energy. An exact solution for the transport of nonrelativistic heavy particles for great depths and large energy losses is obtained. (RWR)

15565 COMPUTATION OF TOTAL YIELD OF BREMSSTRAHLUNG OF ELECTRONS AS A FUNCTION OF THE TARGET THICKNESS. Isaev, V. I.; Kovalev, V. P.; Kharin, V. P.; Gordeev, V. V. Sov. At. Energy (Engl. Transl.); 36: No. 5, 509-510(May 1974).

Translated from At. Energ.; 36: No. 5, 400-401(May 1974).

A method of computing the total yield of electron bremsstrahlung as a function of target thickness is discussed. The yield is computed by using the average characteristics, the average radiation and total losses, and the average energy of the electron at the depth of penetration. Average radiation and total losses of electron energy are represented in the form of linear functions. The absorption of bremsstrahlung in the target is taken into consideration. The total yield of bremsstrahlung as a function of W target thickness is shown for 22-MeV electrons. An expression for the thickness corresponding to the maximum value of the total yield of bremsstrahlung is obtained. (1 figure, 2 tables) (RWR)

15566 ENERGY DEPOSITION BY HIGH-ENERGY ELECTRONS (50 TO 200 Mev) IN WATER. Alsmiller, R. G. Jr.; Barish, J. (Oak Ridge National Lab., Tenn. (USA)); Dodge, S. R. (Chapman College, Orange, California, USA). Nucl. Instrum. Methods; 121: No. 1, 161-167(1 Oct 1974).

The data presented are intended for use in studying the effects of electron contamination in negatively charged pion beams which are used in cancer radiotherapy. Electron photon cascade calculations have been carried out for zero-width beams of electrons with kinetic energies of 50, 100, 150, and 200 MeV normally incident on a water phantom. The energy deposition per unit volume as a function of depth and radius in the phantom is given. To make the results more accessible for treatment planning, a quasi-analytic representation of the energy-deposition data has been obtained and is presented. (auth)

15567 BENCHMARK DATA FOR HIGH ENERGY GAMMA PHOTON PENETRATION THROUGH LOW-Z MATERIALS. Smitton, C. (Scientific Services Department C.E.G.B., North West Region, Manchester, UK); Bishop, G. B. (Liverpool Univ. (UK). Dept. of Mechanical Engineering). Nucl. Instrum. Methods; 121: No. 1, 41-48(1 Oct 1974).

Scalar flux spectra through graphite and aluminium from a 6.13 MeV photon isotropic uniform disc source have been obtained both by refined experimentation and Monte-Carlo calculations. Penetrations of up to 3 mean free paths in graphite and over 4 mean free paths in aluminium are presented. The emerging spectra show domination by Compton interactions. A technique is described for measuring scalar flux spectra using an unshielded NaI(Tl) spectrometer coupled to the unfolding code GAMAK plus a mathematically derived detector cross section. (auth)

15568 IONIZATION OF DIELECTRIC LIQUIDS BY HIGH-ENERGY RADIATION STUDIED BY MEANS OF ELECTRICAL CONDUCTIVITY METHODS. Hummel, A. (Interuniversitair Reactor Instituut, Delft (Netherlands)); Schmidt, W. F. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (F.R. Germany). Sektor Strahlenchemie). Radiat. Res. Rev.; 5: No. 3-4, 199-300(Oct 1974).

215 references.

This review is concerned mainly with the action of high-energy radiation on dielectric liquids and especially hydrocarbons (i.e. liquids with a dielectric constant of $\epsilon_r \sim 2$). Ionization by UV is excluded since little is known for the liquid phase. Measurement techniques for liquid rare gases are included while the results are presented in a general fashion. The spatial distribution of ions and electrons in the track are discussed. Special attention is given to the effects of high-LET radiation. The number of papers published to date is much smaller. (NL)

Radiation Protection Standards

Refer also to abstracts 14011, 14017, 14048, 14342, and 14419.

Radiation Source Calibration and Standardization

Refer also to abstract 14136.

Shielding Calculations and Experiments

Refer also to abstracts 14125, 14736, 14737, 15616, and 15769.

15569 (IKE-4-17) ESTOQ: A PROGRAM FOR THE CALCULATION OF FIRST COLLISION SOURCES IN ORDER TO AVOID THE RAY EFFECT IN TWO-DIMENSIONAL S_N CALCULATIONS. Klumpp, W.; Pfister, G.; Rexer, G. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Kernenergetik). Aug 1973. 82p. (In German). INIS.

The report describes the computer program ESTOQ, developed for the transformation of plane sources into first collision sources for shielding calculations. The first collision source is transmitted to the S_N program in form of moments of a Legendre expansion. (30 figures) (INIS)

15570 (ORNL-TM-4728) TRANSMISSION OF PHOTONS THROUGH COMMON SHIELDING MEDIA. Jones, T. D.; Haywood, F. F. (Oak Ridge National Lab., Tenn. (USA)). Jan 1975. Contract W-7405-eng-26. 30p. Dep. NTIS $4.50.

This analysis of existing transmission factors is primarily intended for shielding photons from a typical thermonuclear weapon and fission products. Results are expected to be accurate and consistent to a penetration depth of four mean free paths, which corresponds to a transmission of about 2%. For applications requiring precise estimates of transmission, these results should be used cautiously because the comparisons of results for point isotropic sources relative to broad beam results indicate that existing buildup factors for ordinary concrete are inconsistent compared to other elements chosen over a wide range of atomic numbers. (auth)

15571 USE OF THE DIFFUSION APPROXIMATION TO CALCULATE SPATIAL AND ENERGY DISTRIBUTIONS OF FAST NEUTRONS. Artem'eva, N. A.; Broder, D. L.; Nikol'skii, G. Yu.; Popkov, K. K. Sov. At. Energy (Engl. Transl.); 36: No. 5, 496-498(May 1974).

Translated from At. Energ.; 36: No. 5, 392-394(May 1974).

Due to the availability of slowing-down lengths, absorption cross sections, and effective diffusion lengths for the spectra of fast neutrons in shielding, effective constants can be used to obtain the spatial and energy distributions for fast-neutron fluxes inside a shield when a system of multigroup equations is to be solved in the diffusion approximation. Calculations of this type with a 26-group system for fast neutrons in water, iron, and graphite agreed with experiment within 15%. To check the application of the method to nonuniform layered shields the spatial and energy distributions were calculated for two shield compositions; theory and experiment differed by not more than 20%. It was concluded that the use of the diffusion approximation with corrected diffusion lengths gives a satisfactory description of the spatial and energy distributions of fast-neutron flux, and the method can be used in the design of biological shielding. (2 figures, 1 table) (RWR)

15572 COMPACT TABLES OF FUNCTIONS FOR USE IN SHIELDING CALCULATIONS. Shure, K.; Wallace, O. J. (Bettis Atomic Power Lab., West Mifflin, PA). Nucl. Sci. Eng.; 56: No. 1, 84-94(Jan 1975).

The exponential integral functions of the first and second kinds, $E_1(b)$ and $E_2(b)$, and the secant (Sievert's) integral, $F(\theta_0,b)$, are useful in calculating radiation fluxes. Values of these functions vary rapidly with the argument b, so that useful tabulations are voluminous and interpolation is difficult. Related functions are defined whose values vary slowly with the argument b and which are readily amenable to linear interpolation. Thus, accurate flux calculations depend only on the availability of an adequate table of the exponential function e^{-b}. Compact tables of these related functions and of three other functions useful in flux calculations are given, together with illustrations of their use in shielding formulas. (8 figures, 5 tables) (auth)

PHYSICS (THEORETICAL)

General

15573 (FEI-430) QUANTUM-MECHANICAL REPRESENTATION OF DISSIPATION SYSTEMS. Svin'in, I. B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1973. 28p. (In Russian). INIS.

A method is proposed for the description of dissipative systems based on the Schroedinger equations. The operative equations of motion were solved for harmonic oscillations with friction and precise solutions of the Schroedinger equations were obtained. The relation between quantum and classical problems was established. The problem of the movement of wave packets in the oscillator potential in the presence of friction was solved precisely. (tr-auth)

15574 (RT/FI-73-33) MARA: A GENERALIZED LEAST SQUARES METHOD FOR NUCLEAR DATA ADJUSTMENT. Faleschini, B.; Petilli, M. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). 1973. 65p. INIS.

In the present report generalized inversion is suggested as a solution method in the problem of nuclear data optimization. How to use the code MARA utilizing this method is also discussed. In addition, the results obtained with MARA are checked by comparison with those from the code HAG using the "maximum likelihood method" of Haggblom and Rowlands. (INIS)

15575 (RT/FI-73-39) AMARA: A CODE USING THE LAGRANGE'S MULTIPLIERS METHOD FOR NUCLEAR DATA ADJUSTMENT. Candini, A.; Petilli, M. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). 1973. 68p. INIS.

The optimization of nuclear data is here treated using the "Lagrange's multipliers method" for the solution. This method seems to gain in calculation time and computer memory, with respect to other methods used, as the code AMARA shows. However, no differences in the values of the solution are observed. (INIS)

15576 COHERENT STATES AND RADIATION OF NONSTATIONARY QUADRATIC SYSTEMS. Ivanova, E. V.; Malkin, I. A.; Man'ko, V. I. (AN SSSR, Moscow. Fizicheskij Inst.). Phys. Lett., A; 50: No. 1, 23-24(4 Nov 1974).

Recently the coherent-state representation has been used for constructing nonradiative transition amplitudes between the coherent states of the system whose Hamiltonian is a general nonstationary quadratic form with respect to coordinates and momenta when the transitions are caused by the nonstationary Hamiltonian itself. The radiation of such quantum systems is calculated. (auth)

15577 A NOTE ON GENERALIZED NONLINEAR LEAST-SQUARES DATA FITTING. MacDonald, J. R. (Texas Instruments, Inc., Dallas (USA)). Nucl. Instrum. Methods; 121: No. 1, 203(1 Oct 1974).

A convenient, accurate method for the solution of the generalized nonlinear least-squares data fitting problem which requires no input derivatives is compared with a recently published approach. (auth)

15578 INTEGRABILITY OF DISCRETE REPRESENTATIONS OF LIE ALGEBRA u(p,q). Mickelsson, J.; Niederle, J. (Ceskoslovenska Akademie Ved, Prague). Ann. Inst. Henri Poincare, Sect. A; 19: No. 2, 171-177(1973).

It is proved that every representation of the discrete series of hermitian representations of Lie algebra u(p,q) constructed by the Gel'fand-Graev method is differential of a unitary one-valued representation of Lie group U(p,q). (auth)

15579 SCHEME OF INTERACTION IN RELATIVISTIC QUANTUM THEORY. Caubet, J. P. (Univ., Poitiers, France). Delft Progr. Rep., Ser. B; 278: No. 16, 1059-1061(17 Apr 1974). (In French).

A probabilistic interpretation of the interaction scheme quantization and derivation is presented: the Klein-Gordon equation (free and forced motion) and perturbed relativistic spinorial equations. (auth)

Quantum Field Theories

Refer also to abstracts 15164, 15179, 15187, 15209, and 15271.

15580 (AD-782205) PHOTONS/TACHYONS IN THE EVANESCENT WAVE ASSOCIATED WITH TOTAL REFLECTION. Costa de Beauregard, O. Translated by E. V. Osgood from Compt. Rend., Ser. B; 270: 773-776(1970). 7p. (NRL-Trans-1294). NTIS $3.00.

The topics discussed are quantum theory tachyons, evanescent waves, and photons. (auth)

15581 (DESY-74/49) RENORMALIZATION OF GAUGE FIELD THEORIES WITH SPONTANEOUS SYMMETRY BREAKING IN THE UNITARY GAUGE. Flume, R. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Oct 1974. 31p. Dep. NTIS (US Sales Only) $4.75.

Renormalization prescriptions are derived for Yang-Mills type theories with spontaneous symmetry breaking in the so called "unitary gauge" yielding a mass shell high energy behavior as good as that of any manifestly renormalizable theory. Taking a smooth high energy behavior of the S-matrix as sole criterion it is shown that the Slavnov identities on the renormalization of the respective model in an equivalent manifestly renormalizable gauge are unnecessary. The arguments apply only to models without massless particles. (auth)

15582 (JINR-P2-8070) QUANTUM THEORY OF ELECTROMAGNETIC FIELD IN RIEMANN SPACE. Pestov, A. B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 19p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

A quantum theory for the electromagnetic field is constructed on the differentiable manifold which is defined as a direct topological product of the time axis and compact orientable three-dimensional Riemann space. (auth)

15583 (PUC-TN-3/74) CONFORMAL TRANSFORMATIONS FOR QUANTIZED FIELDS. Schroer, B.; Swieca, J. A. (Pontificia Universidade Catolica do Rio de Janeiro (Brazil)). Apr 1974. 19p. INIS.

Finite conformal transformations for quantized fields are obtained. The apparent conflict with Einstein's causality is resolved. It is shown that in quantum field theory one is in general dealing with representations of the universal convering group of the conformal group. (auth)

15584 (PUC-TN-6/74) CONFORMAL OPERATOR EXPANSIONS IN THE MINKOWSKI REGION. Swieca, J. A. (Pontificia Universidade Catolica do Rio de Janeiro (Brazil). Instituto de Fisica). May 1974. 10p. INIS.

Conformally covariant operator expansions in the Minkowski region are reexamined under the light of recent results on conformal transformations for quantized fields. The modifications necessary to make the expansions compatible with finite Minkowski conformal transformations are obtained. (auth)

15585 SOURCE DESCRIPTION OF MASSLESS YANG–MILLS QUANTA: PROPAGATOR MODIFICATION. Cox, J. A. Chapel Hill, NC; Univ. of North Carolina (1974). 76p. University Microfilms Order No. 74-26,862.

Thesis (Ph. D.).

Schwinger's source theory is used to develop a description of massless Yang–Mills quanta up to the lowest-order propagator modification, and an explicit comparison is made with the corresponding quantum field theory result. The action expression is extended to include interactions through the requirement that isotopic spin be locally conserved everywhere, and the interaction skeleton is exhibited. Using the primitive interaction as an effective two-particle source, the two-particle emission and absorption amplitudes are obtained and subsequently employed to calculate the lowest-order propagator modification and self-energy for Yang–Mills quanta. The results are shown to conform with unitarity. The source theory result is different from that obtained in field theory in a nontrivial way; in particular, the coefficient of the propagator modification is found to be $+5/48\pi^2$ in source theory and $-10/48\pi^2$ in field theory. It is shown that in this particular case the two formalisms lead to diametrically opposite physical behavior: the field theory result predicts that massless Yang–Mills quanta mediate an interaction which becomes asymptotically free at small distances but suffer catastrophic divergences (infrared) at large distances; source theory, on the other hand, predicts that the interaction mediated by these quanta behaves like the electromagnetic interaction—it increases without bound for small distances and experiences only mild infrared divergences for large distances. Finally, an argument due to Schwinger is presented which shows that the behavior predicted by source theory will hold for all orders in the coupling constant and for all source models. (Diss. Abstr. Int., B)

15586 RENORMALIZABLE GAUGE FIELD THEORIES. Pi, S. Y. Stony Brook, NY; State Univ. of New York (1974). 12p. University Microfilms Order No. 74-27,816.

Thesis (Ph. D.).

Studies of renormalizable gauge field theories are presented. Perturbative calculations are presented in models based on spontaneously broken gauge theories. The proton–neutron mass difference and the pion mass are discussed extensively. Some of the newly predicted phenomena in weak and electromagnetic interactions are studied. The decay rate of a neutral heavy lepton into a neutrino and a photon is estimated. The high energy behavior of neutrino and antineutrino total cross sections is investigated as a test of gauge field models in neutrino reactions. (Diss. Abstr. Int., B)

15587 SCHWINGER'S VARIATIONAL PRINCIPLE IN THE THEORY OF QUANTIZED QUASI-LINEAR FIELDS: THE CASE OF HERMITIAN SCALAR FIELDS. Kamo, H.; Kawai, T. (Osaka City Univ. (Japan). Dept. of Physics). Nucl. Phys., B; 81: No. 2, 349-364(4 Nov 1974).

As an extension of the previous work, Schwinger's variational principle is formulated for the quantized fields which correspond to the classical real scalar fields described by the Lagrangian density $\mathcal{L}_c\ (\mathcal{B}_T\phi,\phi) = -\frac{1}{2}g_{ab}(\phi)\,(\partial_\mu\phi^a)\,(\partial_\mu\phi^b) - V(\phi)$. The c-number variations of field operations $\phi^a(\chi)$ and spacetime coordinate χ are sufficient to give the laws of the quantized fields. The Euler-Lagrange equations, the canonical equations of motion and the canonical commutation relations are derived from this principle. The energy-momentum tensor $T_{\mu\nu}$, energy-momentum vector P_μ and angular-momentum tensor $M_{\mu\nu}$ are introduced in a natural way. The differential conservation law $\partial_\mu T_{\mu\nu} = 0$ is also derived and it is inferred that P_μ and $M_{\nu\lambda}$ should obey the commutation relations which characterize the inhomogeneous Lorentz group. A quantized version of Noether's theorem, which relates the conservation law with the invariance of the action, is established. All resulting relations are consistent with one another, although there arises a pathological situation in the explicit calculation of $\partial_\mu T_{\mu\nu}$. Further, it is shown that the formulation is covariant under an arbitrary change of field variables. The appropriate choice of the quantal Lagrangian density is essential to ensure internal consistency and covariance. The ambiguities in the quantal form of the Lagrangian density are discussed. A comment on the use of Schwinger's criterion for Lorentz invariance is also given. (auth)

15588 SUPERSYMMETRY TRANSFORMATIONS WITH ISOSPIN. Dondi, P. H.; Sohnius, M. (Karlsruhe Univ. (TH) (F.R. Germany)). Nucl. Phys., B; 81: No. 2, 317-329(4 Nov 1974).

An algebra with supersymmetry generators and an internal SU(2) is constructed. The action of the supersymmetry group on a fundamental superfield is obtained, and the supersymmetry transformations of the equivalent set of ordinary fields are exhibited. (auth)

15589 ZIMMERMANN NORMAL PRODUCTS AND THE WILSON EXPANSION. Clark, T. E. (New York Univ., N. Y. (USA). Dept. of Physics). Nucl. Phys., B; 81: No. 2, 263-282 (4 Nov 1974).

The principal part and asymptotic form of the Wilson short distance expansion is derived in the framework of Bogoliubov-Parasiuk-Hepp-Zimmermann renormalized perturbation theory. Use is made of the Zimmermann normal product techniques with all work being performed in the scalar A^4 model. The expansion of the product of four field operators is given as an explicit example. (auth)

15590 INVESTIGATION OF A NON-RENORMALIZABLE LAGRANGIAN MODEL INVARIANT UNDER SUPERTRANSFORMATIONS. Lang, W.; Wess, J. (Karlsruhe Univ. (TH) (F.R. Germany)). Nucl. Phys., B; 81: No. 2, 249-252(4 Nov 1974).

A nonrenormalizable Lagrangian model invariant under supertransformations is studied in the one-loop approximation, and a remarkable cancellation of divergences is found. The model consists of a scalar, pseudoscalar and a Majorana spinor field with equal masses. (auth)

15591 THE CHARGED PARTICLE RADIATION FIELD IN THE ELECTRODYNAMICS OF MOVING MEDIA. Vorontzov, V. I.; Shpak, I. V. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). Phys. Lett., A; 49: No. 6, 459-460(21 Oct 1974).

Sommerfeld's problem of the accelerated charge radiation in a uniformly moving simple medium is solved. The charge particle radiation field in the simple medium moving with uniform velocity $\mu = \beta \cdot c$ may be found by solving the wave equation for the 4-potentials: $\nabla_\alpha\nabla^\alpha a_\nu = -4\pi j_\nu$, where $a_\nu = (-\phi;\mathbf{a})$; $j^\nu = (\rho;c^{-1}\mathbf{j})$. To calculate the covariant 4-vector of the current the medium tensor $\epsilon^{\mu\nu}$ is used which acts as the fundamental tensor in a simple medium. (NL)

15592 QUANTUM AND CLASSICAL RELATIVISTIC ENERGY STATES IN STATIONARY GEOMETRIES. Deruelle, N.; Ruffini, R. (Princeton Univ., N. J. (USA). Joseph Henry Labs.). Phys. Lett., B; 52: No. 4, 437-441(28 Oct 1974).

The positive and negative root states (E^+, E^-) for a particle moving along a geodesic in a stationary background, introduced by Christodoulou and Ruffini, are here interpreted in the framework of a relativistic quantum field theory. It is shown how E^+ and E^- have to be considered as the classical correspondent of the positive- and negative-energy states of a quantized field. It is explicitly shown that crossing between the states E^+ and E^- can occur and, consequently, the necessary condition for particle creation as given by Klein, Sauter, Heisenberg and Euler can be encountered. (auth)

15593 EXPLICIT OPERATOR SOLUTION TO THIRRING MODEL WITH U(n) SYMMETRY. Bhattacharya, G.; Roy, P. (Tata Inst. of Fundamental Research, Bombay (India)). Phys. Lett., B; 52: No. 4, 461-466(28 Oct 1974).

Two explicit solutions to the Thirring model with U(n) symmetry are constructed following Klaiber's approach. Products of fields are obtained in terms of those for the free case, and scale dimensions of composite operators are computed. (auth)

15594 A MANIFESTLY GAUGE-INVARIANT HAMILTONIAN FORMULATION OF CLASSICAL ELECTRODYNAMICS. Balescu, R.; Poulain, M. (Brussels Univ. (Belgium). Faculte des Sciences). Physica; 76: No. 3, 421-444(1974).

A manifestly gauge-invariant hamiltonian formulation of classical electrodynamics is constructed by taking the electromagnetic fields as the basic dynamical quantities, obeying appropriate Lie-bracket relations. The longitudinal parts of the fields can be eliminated completely from the beginning. The theory is relativistically covariant: the generators of the Poincare Lie algebra are given explicitly. Explicit realizations of the Lie-bracket operation are derived (they are different from the usual Poisson brackets), and the relativistic Liouville equations are presented. (auth)

15595 IMPROVED RENORMALIZATION GROUP EQUATIONS WITH DIMENSIONAL REGULARIZATION AND THE ϵ EXPANSIONS. Yu, L. P. (Rutgers–the State Univ., New Brunswick, N. J. (USA). Dept. of Physics). Nucl. Phys., B; 81: No. 3, 458-476(11 Nov 1974).

Due to the absence of dimensional cut-off parameters in the dimensional regularization scheme, vanishing of the unrenormalized mass of the scalar boson implies vanishing of its renormalized mass; thus the masses of both bosons and fermions in renormalizable field theories can be made finite by multiplicative mass renormalizations. The improved renormalization group equations in D dimensions are derived in such a way that both the large (or the small) momentum limits and the Wilson ϵ expansions can be uniformly treated for the fermion as well as the boson cases. The improved equations for ϕ^4_4 theory, ϕ^4_4 theory, quantum electrodynamics, massive vector-gluon model, and non-Abelian gauge theories incorporating fermions are discussed. For the latter three classes of theories, the gauge-dependent problem of the coefficient functions in the improved renormalization group equations is discussed. (auth)

15596 SECOND QUANTIZATION. Caubet, J. P. (Univ., Poitiers, France). Compt. Rend., Ser. A; 278: No. 19, 1271-1273(6 May 1974). (In French).

A probabilistic construction of the second quantization formalism is given. (auth)

15597 VERTEX FUNCTION LSZ THEOREM AND GHOST PROBLEM IN THE LEE MODEL. Caramico D'Auria, A. (Facolta di Ingegneria, Naples); Esposito, U. Nuovo Cim., 24A: No. 2, 129-142(16 Nov 1974).

The presence of ghosts in the Lee models is investigated. It was pointed out that in the Lee model there are no ghosts if the correct kinematics is used. This statement seems to disagree with the LSZ theorem on the vertex function, which asserts that in a theory containing no ghosts the vertex function must vanish to infinity. As the Lee model has a constant vertex function it may contain ghosts, whatever kinematics is used. (auth)

15598 RENORMALIZATION GROUP EQUATION AND ITS SOLUTION IN GAUGE THEORIES. Collecott, P. S. (Univ. of Cambridge, Eng.). Nuovo Cim., 24A: No. 2, 183-201(16 Nov 1974).

Non-Abelian gauge theories involving massive spin-$\frac{1}{2}$ fermions and scalar fields without spontaneous symmetry breaking are considered in an arbitrary gauge. The renormalization group equation and its solution are derived in the one-loop approximation, using a mass-independent dimensional regularization procedure, in terms of effective coupling constant, mass and gauge parameters. In the case of an SU_2 theory, the various Ward-Taylor identities, and the gauge independence of physical quantities are confirmed in the course of studying some properties of the solutions of the renormalization group equation. Some

extensions of results to larger groups and more complicated couplings are given. (auth)

15599 IMAGINARY QUANTITIES IN SUPERLUMINAL LORENTZ TRANSFORMATIONS. Corben, H. C. (Univ. of Toronto). Lett. Nuovo Cim.; 11: No. 11, 533-536(16 Nov 1974).

The physical interpretation of the imaginary quantities to which superluminal transformations lead is discussed. (JFP)

15600 DIRAC PARTICLE IN A SCALAR COULOMB FIELD. Vasconcelos, J. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). Rev. Brasil. Fis.; 1: No. 3, 441-450(Dec 1971).

It is shown that the problem of a Dirac particle in an external potential, which is a superposition of attractive vector and scalar potentials, both of Coulomb form, admits, for bound-states, an exact solution. As particular cases, the bound-state problem for the pure vector Coulomb and scalar Coulomb cases are derived. The degeneracy patterns of the spectra are discussed as well as the role of 0(4,1) as the spectrum generating algebra. The magnetic moments of the bound-states, in both scalar and vector cases, are also discussed. (INIS)

15601 COVARIANT MELLIN TRANSFORMS AND THE WEYL GROUP QUANTIZATION. Lukierski, J. (Department of Physics, Trier, Kaiserslautern University, Kaiserslautern, F.R. Germany). Phys. Lett.; 53B: No. 1, 89-92(11 Nov 1974).

The outline of the formalism with diagonalized dilation generator is presented. The covariant Mellin transform defining quanta with definite dimensionality and SL(2,C) quantum numbers is proposed. (auth)

15602 PERTURBATION THEORY IN TERMS OF SUPERFIELDS. Krause, F.; Scheunert, M. (Bonn Univ. (F.R. Germany). Physikalisches Inst.); Honerkamp, J.; Schlindwein, M. (Freiburg Univ. (F.R. Germany). Fakultaet fuer Physik). Phys. Lett.; 53B: No. 1, 60-64(11 Nov 1974).

A perturbation theory in terms of superfields has been developed for a class of super-symmetric Lagrangians which contain massless spin-zero boson and spin-$\frac{1}{2}$ Majorana spinor fields. (auth)

15603 THE VARIATION OF THE VACUUM POLARIZATION POTENTIAL OF ORDER $(Z\alpha)^3$ ON NUCLEAR CHARGE DISTRIBUTIONS. Calmet, J. (European Organization for Nuclear Research, Geneva (Switzerland)); Owen, D. A. (Ben-Gurion Univ. of the Negev, Beersheba (Israel)). Phys. Lett.; 53B: No. 1, 67-69 (11 Nov 1974).

Nuclear size effects are calculated using the expression for the vacuum polarization potential of order $(Z\alpha)^3$ previously derived by Owen. The dependence of this potential on nuclear charge distributions is shown for point charge, Yukawa and exponential distributions for ^{208}Pb. (auth)

15604 DEEP INELASTIC SCALING BEHAVIOUR AND THE FRAMEWORK OF THE RENORMALIZATION GROUP. Schlereth, H. (Technische Hochschule Aachen (F.R. Germany). 3. Physikalisches Inst.). Phys. Lett.; 53B: No. 1, 96-100(11 Nov 1974).

Possible consequences of the scaling behavior of the quantities $\nu W_2^p(\nu,Q^2)$, $\nu W_2^n(\nu,Q^2)$ and $\sigma_{e^+e^-}^{tot}(s)$ in the framework of the renormalization group are considered. In order to be able to apply this framework in the timelike region it is assumed throughout this paper that the events are in a truly asymptotic regime, hence far off any threshold. (auth)

15605 EXTENDED PARTICLES AND SOLITONS. Cahill, K. (Ecole Polytechnique, 75-Paris (France). Centre de Physique Theorique). Phys. Lett.; 53B: No. 2, 174-176(25 Nov 1974).

A variational method is introduced for approximating the eigenstates of the Hamiltonian in relativistic quantum field theory. The method has three ingredients: the coherent states, the solutions of the corresponding classical field theory, and the generator-coordinate technique of nuclear physics. It provides a quantum-mechanical interpretation for solitons, some of which resemble extended particles. (auth)

15606 SCALING LAW AND MASS SINGULARITY IN RENORMALIZABLE QUANTUM FIELD THEORY. Shimizu, Y.; Sugawara, H. (Tokyo Univ.). pp 506-514 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

The electron-positron scattering in the deep inelastic region is considered taking the model which consists of neutral pions and protons interacting through the pseudoscalar coupling. The breaking of the scaling law and mass singularities are noted. (JFP)

15607 INDEFINITE-METRIC QUANTUM FIELD THEORY WITH SPONTANEOUSLY BROKEN GAUGE INVARIANCE. Nakanishi, N. (Kyoto Univ., Japan). pp 578-591 of Proceedings of the International Symposium on High Energy Physics. Hara, Y. (ed.). Tokyo; Tokyo Univ. (1973).

From international symposium on high energy physics; Tokyo, Japan (23 Jul 1973). See CONF-730731-.

The starting point of the discussion of the indefinite-metric quantum field theory with spontaneously broken gauge invariance is the Landau-gauge formalism of a massless vector field. The formalism of the spontaneously broken gauge theory is thus based on the Landau-gauge quantum electrodynamics. (auth)

Gravitation and General Relativity

15608 COSMOLOGICAL SINGULARITIES AND HIGHER-ORDER GRAVITATIONAL LAGRANGIANS. Giesswein, M.; Sexl, R.; Streeruwitz, E. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik). Phys. Lett., B; 52: No. 4, 442-444(28 Oct 1974).

General relativity is modified by adding terms proportional to R^2 and $R^{\mu\nu}\,R_{\mu\nu}$ to the Lagrangian. One class of solutions of the modified field equations is free of singularities, but does not lead to asymptotic behavior (for large time) of the Friedmann type. A second class, which shows the correct asymptotic behavior, does contain the usual singularities of Friedmann universes, collapse being modulated by small oscillations only. The quantum effects considered here are thus unable to prevent the occurrence of cosmological singularities under physically reasonable conditions. (auth)

15609 THE ONE-LOOP NEUTRINO CONTRIBUTION TO THE GRAVITON PROPAGATOR. Capper, D. M. (Imperial Coll. of Science and Technology, London (UK). Dept. of Physics); Duff, M. J. (Oxford Univ. (UK). Dept. of Astrophysics). Nucl. Phys., B; 82: No. 1, 147-154(18 Nov 1974).

The one-loop neutrino correction to the graviton propagator is calculated using the technique of dimensional regularization. The resulting amplitude satisfies the Slavnov-Ward identities and the divergent part can be cancelled by a pole term of the form $\Delta\,\xi = (\sqrt{-g}/(2-\omega)(4\pi)^2\,120)\,[R^2-3R_{\mu\nu}\,R^{\mu\nu}]$. If, however, the appearance of a somewhat unusual anomaly is to be avoided, it is essential that the counterterm be in a continuous (2ω) number of dimensions rather than 4, in which case $\Delta\,\xi\ (\sqrt{-g}\,2^{\omega}/2-\omega)(4\pi)^2\,32(4\omega^2-1))\,[\frac{1}{2}\omega R^2-(2\omega-1)R_{\mu\nu}\,R^{\mu\nu}]$. (auth)

15610 SPACE, TIME, AND SPACETIME. Sklar, L. Berkeley, CA; University of California Press (1974). 432p. (ISBN-0-520-02433-8). $15.00.

The discussion covers the epistemology of geometry, absolute motion and substantial space-time, causal and temporal order, and the direction of time. (JFP)

15611 TWO PROBLEMS IN GENERAL RELATIVITY. I. Evolving Dust Shells. II. Kerr-Newman Metrics, Spinning Charged Sources, and Their Gyromagnetic Ratios. Siegel, H. P. Waltham, MA; Brandeis Univ. (1974). 298p. University Microfilms Order No. 74-28,016.

Thesis (Ph. D.).

The Arnowitt-Deser-Misner canonical formulation of general relativity is used to treat two problems. The first problem is the time-evolution of spherically symmetric charged dust shells. The detailed 3-geometry of space-like hypersurfaces embedded in space-time is studied. It is found that under well-defined conditions, the 3-geometry "flips over" from being open and asymptotically flat to being closed, with a curvature invariant becoming singular at the closure point. It is observed that the ADM procedure has produced the maximal extension of space-time for this system. The stimulus for the second problem was the observation that the gyromagnetic ratio of the Kerr-Newman exterior solution to the coupled Einstein-Maxwell equations is 2 rather than 1. This is in apparent contradiction to a special relativistic theorem that the gyromagnetic ratio for classical systems with a uniform ratio of charge-density to mass-density must be unity. One wonders if this anomalous value is a general consequence of general relativity for extremely condensed systems. So, the fields generated by simple material sources possessing charge and angular momentum are studied with the intention of eventual comparison to the Kerr-Newman fields. First, it is pointed out that the theorem fails even in flat space, if one permits relativistic particle velocity and/or extremely condensed sources. The material sources whose fields are studied are charged rotating dust shells; only the initial value problem is considered. Several possible choices of initial condition on the Maxwell field are discussed. After the gravitational field equations are reduced, it is found that solution is possible only if the reduced equations are expanded in powers of the rotation parameter. Zeroth-order terms yield leading-order mass renormalization. First-order terms, which may be analyzed only by numerical methods, give the angular momentum and magnetic moment. It is found that as shell size is limited from large to small, the gyromagnetic ratio goes from 1 to 2. This result is independent of charge to bare mass ratio. Second-order terms are used to find

the evolution of the initial hypersurface. Electromagnetic radiation inevitably appears, so it is concluded that these material systems are not sources of the stationary Kerr-Newman metric. (Diss. Abstr. Int., B)

15612 IMPROVED HAMILTONIAN FOR GENERAL RELATIVITY. Regge, T. (Institute for Advanced Study, Princeton, N. J. (USA)); Teitelboim, C. (Princeton Univ., N. J. (USA). Joseph Henry Labs.). Phys. Lett.; 53B: No. 1, 101-105(11 Nov 1974).

A Hamiltonian formalism for asymptotically flat spaces in general relativity which is manifestly covariant under Poincare transformations at infinity is proposed, and some of its implications are briefly discussed. (auth)

REACTOR TECHNOLOGY AND REGULATION

15613 MODERN TRAINING METHODS AND EQUIPMENT FOR ELECTRIC POWER PLANT PERSONNEL. Panek, J. Energetika; 24: No. 11, 462-467(Nov 1974). (In Czech).

Reasons for the use of simulating equipment for the training of operators of large power production units are discussed, along with experience in the use of such simulators. Individual phases of operator training using special training equipment are discussed. Simulating equipment employed by foreign fossil fuel and nuclear power stations are reviewed. (auth)

Power Reactors, Non-Breeding, BWR-Type

Refer also to abstracts 15729 and 15752.

15614 (CONF-7309129-1) INTERGRANULAR STRESS-ASSISTED CORROSION CRACKING OF AUSTENITIC ALLOYS IN WATER-COOLED NUCLEAR REACTORS. Cheng, C. F. (Argonne National Lab., Ill. (USA)). Aug 1974. 55p. Dep. NTIS $5.75.

From 5th European congress on corrosion; Paris, France (24 Sep 1973).

Corrosion-cracking incidents of structural components and fuel-element cladding in 30 water-cooled reactors have been reported. All pressure boundary penetrations have small seeping leaks, but pipe severance has not occurred. Failures of the non-pressurized boundary components have been limited to small fasteners and screws, none of which have constituted potential nuclear safety hazards, directly or indirectly, nor damage involving other components. The cracking incidents involving Types 304, 304L, and 347 stainless steel, Incoloy 800, and Inconel 600 were attributed to intergranular stress-assisted corrosion cracking associated with (a) oxygen, (b) caustic, or (c) hydrogen. Sensitization increases the susceptibility to cracking in dissolved oxygen, but it is not a factor in caustic solution. Other material conditions, corrective actions, and mechanisms of intergranular stress-assisted corrosion cracking are discussed. (49 references) (auth)

15615 (CONF-741065-34) CONTRIBUTION TO THE EXPERIENCE OF NOISE MEASUREMENTS AND ANALYSIS IN A BWR POWER PLANT. Blomberg, P. E.; Akerhielm, F. (Aktiebolaget Atomenergi, Studsvik (Sweden)). 1974. 18p. Dep. NTIS (US Sales Only) $4.00.

From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

The feasibility and potential use of noise measurements in a nuclear power plant have been examined in experiments carried out in the Oskarshamn I BWR-plant. The results indicate that important information can be derived by analysis of dynamic data. It is concluded, however, that the confidence placed in the interpretation of such measurements, and the possibility of extracting information of a quantitative character, demand both extensive knowledge of the background characteristics of the plant concerned and access to results of similar measurements made in other plants. The study included measurement of the following process variables: neutron flux, core pressure drop, steam flow, generated electric power, coolant flow and the flow and temperature of the feed water. The sampled data were analyzed by an on-line digital computer designed specially for the purpose. Power spectra and cross correlation functions were the main items computed. From the results it has been possible to extract specific information regarding, for example, inherent oscillations, transport delays, void fraction distribution and the extent of the coupling between process variables. (auth)

15616 (RP-8) RADIATION SHIELDING DESIGN AND ANALYSIS APPROACH FOR LIGHT WATER REACTOR POWER PLANTS. (Stone and Webster Engineering Corp., Boston, Mass. (USA)). Apr 1974. 418p.

Information is presented concerning shield design approach for water-cooled power reactors, BWR shield design and analysis, PWR shield design and analysis, methods of analysis, and basic data. (DCC)

Power Reactors, Non-Breeding, PWR-Type

Refer also to abstracts 15614, 15616, 15729, 15735, 15736, 15744, 15752, 15797, and 15798.

15617 (BAW-10084) PROGRAM TO DETERMINE IN-REACTOR PERFORMANCE OF B AND W FUELS. Cladding Creep Collapse. Eckert, A. F. J.; Wilson, H. W.; Yoon, K. E. (Babcock and Wilcox Co., Lynchburg, Va. (USA). Nuclear Power Generation Div.). Nov 1974. 58p.

The determination of the creep rate for B & W Zircaloy-4 fuel rod cladding is described. The development of the computer code, the verification with experimental data, and the development of the collapse criteria are presented. The use of the analytical method in analyzing power reactors is discussed. A sensitivity study using the CROV code is given. The conservatisms in the analytical procedure are discussed. (auth)

Power Reactors, Non-Breeding, Graphite Moderated

Refer also to abstracts 14224, 15726, 15733, and 15776.

15618 (GA-A-12971) FUEL PARTICLE BEHAVIOR UNDER NORMAL AND TRANSIENT CONDITIONS. Smith, C. L. (General Atomic Co., San Diego, Calif. (USA)). 1 Oct 1974. Contract AT(04-3)-167. 58p. (GA-LTR-15). Dep. NTIS $5.45.

Large HTGR fuel particles consist of pyrocarbon (PyC) and silicon-carbide (SiC) coated UC_2 and ThO_2 fuel kernels. These coatings on individual fissile and fertile fuel particles are the primary barriers to the release of fission products from the fuel particles. Low fission product release rates therefore imply a high degree of particle coating integrity. An extensive irradiation and out-of-pile test program has shown that particle survival rates in excess of 99% can be expected from fuel operating in an HTGR environment. The test programs have, however, identified four phenomena that control fuel-particle performance in the thermal/nuclear environment of a large HTGR core. These phenomena are described and their effects on fuel performance are discussed. 22 references. (auth)

15619 (ORNL-TM-4760) INITIAL ASSESSMENT OF THE STATUS OF HTGR METALLIC STRUCTURAL MATERIALS TECHNOLOGY. Rittenhouse, P. L. (Oak Ridge National Lab., Tenn. (USA)). Dec 1974. Contract W-7405-eng-26. 57p. Dep. NTIS $5.45.

This report provides an interim assessment of the status of technology of the metallic components of the HTGR primary system. Major components such as the steam generator and helium circulator—and their materials of construction—are described, and areas of uncertainty, particularly as they may relate to the safety of the system, are identified. Ongoing research aimed at the improvement and refinement of HTGR component and materials technology is summarized, and suggestions and priorities are given for present and future work. (auth)

15620 (RD/B/N-2942) MEASUREMENTS OF TEMPERATURE FLUCTUATIONS IN A GAS-COOLED POWER REACTOR. Greef, C. P. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Feb 1974. 33p. (CONF-741065-16). Dep. NTIS (US Sales Only) $4.75.

From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

Studies of thermocouple noise signals from a graphite-moderated, gas-cooled reactor are presented. An overall survey demonstrated that, in the frequency range covered (up to 0.15 Hz), the reactor behaved as a closely coupled system with no significant phase differences between different parts of the core. Furthermore, the temperature noise power spectra could be divided into two distinct frequency regions in this range. In the lower part of the range the observed fluctuations were found to be due to overall reactor power fluctuations, and in the upper part to heat transfer coefficient variations. A simple model of the noise processes in the reactor has been developed and verified by consideration of the transfer function between coolant and fuel temperatures. The channel gas outlet thermocouple response, which was required for reactor fault studies, was measured by conventional rod oscillation techniques and noise analysis using both intrinsic fluctuations and refuelling transients. A comparison of the results showed that noise analysis, especially using refuelling transients, was capable of replacing the rod oscillation technique. This gave the advantages of not interfering with the normal operation of the reactor, reducing the experimental time and extending the frequency range of the measurements. (auth)

15621 (TRG-REPORT-2033(S/X)) ELASTIC THERMAL BOWING OF NUCLEAR FUEL PINS CONTAINING A CRACKED

FUEL. Gardner, L. R. T. (UKAEA Reactor Group, Risley). 1974. 32p. Dep. NTIS (US Sales Only) $4.75. UK £1.00.

The effect of a cracked fuel on the thermally bowed shape of a nuclear fuel pin and on the required loads is analysed in general terms for elastic materials. The cracked fuel is supposed not to support tensile stresses. Algebraic equations for some simple thermally bowed configurations are derived and applied to an assessment of the effect of cracked fuel in an experimental fuel pin. The results show that, for the experiment analysed, the loads put onto the grids are nearer to the results for a can with no fuel than to the results for a can which contains uncracked fuel in intimate contact. The analysis gives one of the few solutions for cracked media which can be expressed in a closed form. 10 references. (auth)

Power Reactors, Non-Breeding, Otherwise Moderated

15622 (CONF-741065-32) CANADIAN EXPERIENCE IN THE AREA OF REACTOR NOISE. Serdula, K. J. (Atomic Energy of Canada Ltd., Chalk River, Ontario). 1974. 27p. Dep. NTIS (US Sales Only) $4.50.

From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

Canadian experience in developing and applying reactor noise measurements and analysis is reported. Noise measurements were made at the Gentilly G1 reactor at various conditions of operation and single or multiple records analyzed for probability density functions, cross-spectral density functions, response functions (gain and phase), coherence functions, data conditioning, etc. Also, the controlled and uncontrolled response of the neutron flux to spatial reactivity perturbations was studied and compared to model responses. Some resonances were traced to their source and then controlled, in some cases by adjusting valve actuating systems. The results and conclusions were communicated to the commissioning, operating and design staff. (LTN)

15623 (ZJE-144) PROGRAM OF IN-CORE MEASUREMENTS. Part 1. Routine Verification of A-1 Reactor Core Design Parameters. Krett, V.; Kott, J.; Velechovsky, V. (Skoda, Plzen (Czechoslovakia)). 1974. 22p. Dep. NTIS (US Sales Only) $4.25.

The basic philosophy of measuring the thermal characteristics of the 1st Czechoslovak nuclear power station reactor core is described. Design features and techniques of measurement for special fuel assemblies with in-core instrumentation are specified. The tests included determination of actual operating parameters of fuel assemblies, namely surface temperature of fuel can, temperature of uranium core, input and output temperature of the coolant, coolant throughflow in fuel assembly, thermal as well as dynamic loading of rods, fuel burn-up, and the spatial distribution of the generation of heat in uranium. Extensive post-irradiation examination was incorporated into the program. (auth)

Power Reactors, Breeding

Refer also to abstracts 14223, 14538, and 15722.

15624 (AI-AEC-13137) FUELS, MATERIALS, AND CONTROL ROD DEVELOPMENT PROGRAMS, JULY–SEPTEMBER 1974. Quarterly Technical Progress Report. (Atomics International Div., Conoga Park, Calif. (USA)). 1974. Contract AT(04-3)-824. 29p. AT.

Progress is reported in the following areas: irradiation damage studies in LMFBR cladding and core structural materials, helium generation studies in reactor materials, and control absorber heating experiments and calculations. (DCC)

15625 (AI-AEC-13138) SODIUM TECHNOLOGY AND COVER GAS SEAL DEVELOPMENT PROGRAMS. Quarterly Technical Progress Report, July–September 1974. (Atomics International Div., Canoga Park, Calif. (USA)). 15 Nov 1974. Contract AT(04-3)-824. 67p. AT.

Progress made in the development and testing of techniques and procedures for the cleaning and storage of LMFBR coolant loop components is reported. Friction test data on FFTF materials are presented. The testing of cover gas seals for LMFBR and FFTF cooling systems is described. (DCC)

15626 (ANL-CT-75-06) PARABOW: A SECOND GENERATION TWO-DIMENSIONAL REACTOR CORE STRUCTURAL ANALYSIS CODE. Moran, T. J. (Argonne National Lab., Ill. (USA)). Nov 1974. Contract W-31-109-eng-38. 86p. AT.

The FORTRAN IV computer code PARABOW developed at ANL for LMFBR core restraint studies is presented. The objective of the PARABOW code was to provide a flexible, two-dimensional, core structural analysis code which was capable of modeling three-dimensional effects, frictional effects, and the effects of duct misalignment by a combination of analytical and empirical methods. Experimental data for use in developing empirical models is expected to come from the Westinghouse Core Restraint Test Facility. A detailed description is presented of the computer code PARABOW including a FORTRAN listing and a sample problem not related to core restraint analysis. 4 references. (auth)

15627 (ANL-CT-75-15) ELASTIC MODELING TECHNIQUES FOR THE CORE STRUCTURAL ANALYSIS CODE PARABOW. Moran, T. J. (Argonne National Lab., Ill. (USA)). Dec 1974. Contract W-31-109-eng-38. 39p. AT.

Reactor core structural modeling techniques developed for use with the reactor core structural analysis code PARABOW are documented. The PARABOW code provides a flexible tool for calculating equilibrium configurations of parallel beam elements connected by nonlinear force elements. The modeling techniques described in this document provide the basis for modeling three dimensional elastic effects within the context of the two dimensional code. The approach to reactor core modeling involves a row averaging procedure augmented by inclusion of the effects of deviations from the row average. It includes the effects of both radial and bridging forces in determining radial positions of ducts and makes use of full three-dimensional bowed shapes due to creep, swelling, and thermal effects. Also included is a brief qualitative description of empirical modifications to the model to include the effects of friction, misalignment, and duct rotation. A sample problem related to the Westinghouse Core Restraint Test Facility is included. 4 references. (auth)

15628 (BNWL-TR-134) INVESTIGATION OF THE TEMPERATURE DISTRIBUTION AND COOLANT FLOW RATE IN THE CORE ASSEMBLIES OF THE BOR-60 REACTOR. Gryatsev, V. M.; Kondrat'ev, V. I.; Krupkin, L. K.; Maznyi, V. F. Translated from Kernenergie; 17: No. 6, 164-170(1974). 17p. Dep. NTIS $4.00.

The temperature distribution and coolant flow rates in the core assemblies of the BOR-60 reactor are presented for operation of the reactor at various powers. The nonuniformity coefficients of the core temperature distribution are determined. (auth)

15629 (CONF-741065-35) SOME CONSIDERATIONS ON NEUTRON INSTRUMENTATION REQUIREMENTS FOR MALFUNCTION DIAGNOSIS IN POWER REACTORS USING NOISE ANALYSIS TECHNIQUES. Edelmann, M. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik). 1974. 27p. Dep. NTIS (US Sales Only) $4.50.

From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

To determine the response of a neutron detector to local perturbations in a typical fast breeder reactor, detailed numerical calculations of space-dependent source transfer functions were performed for the German proto-type reactor SNR 300. The small local reactivity perturbations considered here were replaced by a neutron source modulation for simplicity reasons. The source transfer function was obtained from the Laplace transform of the time-dependent inhomogeneous diffusion equation. The 26 groups KFK-INR cross section set and one-dimensional cylinder geometry were used for the numerical solution of the diffusion equation in the frequency domain. The detector was treated as an integral part of the reactor. The detector materials B-10, U-235 and Pu-239 were chosen for comparison. The positions of source and detector were independently varied within the core and blanket of the reactor. From the space-dependent transfer function of the reactor-detector system and the general theory relating power spectral densities of neutron detector signals and reactivity perturbations for the point reactor model, the neutron instrumentation requirements for detecting local perturbations in a fast reactor were deduced. It was found that, in the present class of fast breeder prototype reactors, no in-core neutron detectors will be needed for a continuous inspection using noise analysis techniques to detect local perturbations. (auth)

15630 (COO-2245-13) COOLANT MIXING IN LMFBR ROD BUNDLES. Quarterly Progress Report, June 1–August 31, 1974. Todreas, N. E. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering). 1974. Contract AT(11-1)-2245. 29p. Dep. NTIS $4.00.

Progress is reported on the development of analytical models and measuring equipment and methods for studying coolant mixing in LMFBR channels and in assessing available hydraulic test data on such mixing. 10 references. (DCC)

15631 (RT/ING-(74)22) DIRECT AND INDIRECT HEATING EFFECT IN THE DNB TESTS FOR SODIUM HEATED STEAM GENERATORS FOR LMFBR'S. Cumo, M.; Farello, G. E.;

Maciuca, C. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Jul 1974. 22p. Dep. NTIS (US Sales Only) $4.25.

LMFBR steam generator design requires a knowledge of the dry out or burn-out power. Electrically heated test sections have greater heated lengths and lower heat fluxes than reactor core channels, so that most of the existing burn-out correlations fail in predicting the burn-out power. The question arises if the electrically heated test sections are equivalent to the dry out power determinations in the actual indirectly heated systems. The testing in actual conditions (sodium water systems) does not permit accurate measurement of the dry out power as, on the contrary, is possible in electrically Joule heated systems. The difference between the two basic boundary heating conditions and relations to correct the results obtained in Joule heated systems are described. (auth)

15632 (WASH-1354) COMPARISON OF FOREIGN AND U. S. LMFBR PLANT PARAMETERS. (USAEC Division of Reactor Research and Development, Washington, D. C.). 29 Nov 1974. 5p. Dep. NTIS $4.00.

A detailed comparison of selected foreign and U. S. LMFBR nuclear and plant design parameters is presented in tabular form, based on information presently available to the general public. A review of such data should permit a rapid assessment of significant variations and the different approaches being used or considered. (LTN)

15633 SAFETY ASPECTS OF SNR-300. Bonsel, W. G. (Stichting Reactor Centrum Nederland, The Hague). Atoomenergie Haar Toepass.; 16: No. 10, 229-235(Oct 1974). (In Dutch).

The arrangements for continuous, automatic monitoring of temperature, pressure, radioactivity, etc. at key points in the reactor system are described. The "maximum credible accidents," involving e.g. total simultaneous failure of all pumps and/or severe coolant-duct rupture are discussed. (NL)

15634 MAIN CIRCUIT COMPONENTS OF SNR-300. Mante, A. J. H. (Neratoom N. V., The Hague (Netherlands)). Atoomenergie Haar Toepass.; 16: No. 10, 219-228(Oct 1974). (In Dutch).

Detailed technical specifications are presented for the primary and secondary liquid Na coolant circuits, and for the steam generator circuits. Operational experience since 1971 is reviewed. Electrical output is currently averaging around 80MW, but technical and operational modifications are proposed which should raise this to 90MW or more. (NL)

15635 GENERAL DESCRIPTION OF SNR-300. de Boer, G. A. (Neratoom N. V., The Hague (Netherlands)). Atoomenergie Haar Toepass.; 16: No. 10, 215-218(Oct 1974). (In Dutch).

The main technical parameters are summarized, and operating experience to date for this prototype sodium-cooled fast breeder reactor are reviewed. Some typical parameters are core dia. 2.6m; core height 1.75m; no. of fuel elements 151 (plutonium oxide fuel, 169 pins per element); coolant inlet temp. 377°C; coolant outlet temp. 546°C; thermal power generated ~730MW. The text is illustrated by a detailed exploded-view diagram of the reactor with its containment structure, and by simplified diagrams of the coolant and electrical circuits. (NL)

15636 THE PROMISE OF FAST BREEDER REACTORS. Iyengar, P. K. (Bhabha Atomic Research Centre, Bombay (India)). Nucl. India; 12: No. 5, 14-17(Jan 1974).

The principles of design of thermal reactors and fast reactors are outlined. The advantages of the fast breeder reactors over the thermal reactors are mentioned. The breeder reactor concept is based on the fuel breeding cycle $^{232}Th-^{233}U$ and this has particular significance for India which is rich in resources of thorium. The compact and smaller size of the reactor, the better utilization of neutron flux and breeding properties offer justification for switching over to fast breeder reactors from thermal reactors, for power generation. The engineering problems involved in designing and operating fast reactors are discussed. The choice of sodium as a coolant in fast breeder reactors is explained. A schematic diagram of a sodium-cooled fast breeder power reactor is shown. The efficiency of sodium-cooled fast reactors is found to be higher than that of thermal reactors. Mention is made of the Fast Breeder Test Reactor (FBTR) set up at Kalpakkam for research in fast breeder reactors and also of the plutonium fuelled zero energy reactor PURNIMA at Trombay. (INIS)

15637 MOLTEN PLUTONIUM CHLORIDES FAST BREEDER REACTOR COOLED BY MOLTEN URANIUM CHLORIDE. Taube, M.; Ligou, J. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Ann. Nucl. Sci. Eng.; 1: No. 4, 277-281(Apr 1974).

A fast breeder reactor of ~2000 MW(t) output using molten chlorides as fuel and coolant is discussed. Some of the most significant characteristics are: the liquid fuel contains only $PuCl_3/NaCl$; the coolant is molten $UCl_3/NaCl$ which also forms the fertile material along with the blanket system, also $UCl_3/NaCl$: the coolant blanket system is divided into 2 or more independent circuits; the fuel circulates through the core, which is not divided, by forced convection. The thermal stability of the reactor is very good. Power excursions or fuel temperature transients are quickly damped by the phenomena of fuel expansion pushing part of the fissile material out of the critical zone. The loss of coolant accident results in a loss of half (or $\frac{1}{3}$, $\frac{2}{3}$) of blanket which, without relying on a reactor scram, results in an automatic adjustment of the reactor power level. Corrosion effects form the most difficult problem. Thermodynamic studies suggest the use of molybdenum alloys as structural materials. (auth)

15638 PRESSURE VESSEL FOR NUCLEAR REACTORS SUITABLY COOLED WITH LIQUID METALS. Rajakovics, G. Czech Patent 148262. 31 May 1972. 4p. (In Czech).

Right of priority for Austria as of 21 Jul 1970 (A 7586/70).

The design of a fast-reactor pressure vessel is described. The pressure vessel consists of an outer vessel and an inner vessel and a space between the two vessels containing an isolation layer of mineral wool, asbestos fibres, and inorganic fillers. The thermoisolation layer is lined with a tin cover with one or more dilatation sectors on its outer wall. The advantage of the pressure vessel thus designed is in the possibility of using a higher-temperature coolant while using common structural materials for pressure vessels. (INIS)

Research, Test, and Experimental Reactors

Refer also to abstracts 14677, 14678, 15625, 15722 and 15724.

15639 (CEA-N-1717) MOTION OF SOLID FISSION PRODUCTS IN AN IRRADIATION LOOP FULL WITH AIR AT THE ATMOSPHERIC PRESSURE. Le Meur, R.; Rouvier, P. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Services d'Electronique). 12 Mar 1974. 19p. (In French). Dep. NTIS (US Sales Only) $4.00.

Gaseous fission products, krypton and xenon, are easily transported by other gases. By radioactive decay they produce solid elements, which are trapped on tubes and filters. Solid fission products, without gaseous precursors generally, remain on the reactor structures near the place of formation. A particular type of solid fission product transport is investigated by a gas-jet technique which uses a capillary tube and a vacuum chamber to precipitate fission fragments. Transport also occurs in other cases. Solid fission products, without gaseous precursors, are transported by air at atmospheric pressure in a loop of OSIRIS reactor. A filter located at more than 20 meters from a fission source is analyzed with a Ge-Li spectrometer. The results show that long-lived fission products, without gaseous precursors are present: molybdenum-99, ruthenium-103, antimony-127, tellurium-132, neodymium-147. Measured activities are compared to calculated values, in the hypothesis of transport of solid fission products. The transport efficiency of these solid fission products is estimated to be about a tenth of that of barium-140, produced from radioactive decay of the gas xenon-140. (FR)

15640 (CEA-N-1747) REACTIVITY AND SOURCE ESTIMATION USING EXTENDED KALMAN FILTERING TECHNIQUE. Poujol, A.; Zwingelstein, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Services d'Electronique). 22 May 1974. 13p. (In French). Dep. NTIS (US Sales Only) $4.00.

A numerical method (extended Kalman filter) is used for estimating in real time the reactivity and source of a nuclear subcritical reactor, from neutron density measurements recorded on reactor Ulysse. Provided an approximate model of rods' effectiveness is available, the results obtained show a good convergence of the estimates, even if the real values of the parameters are known with very poor precision. (FR)

15641 (CONF-741065-7) ON-LINE SUBCRITICAL REACTIVITY METER BASED ON A NOVEL REACTOR NOISE ANALYSIS TECHNIQUE IN THE TIME DOMAIN. Behringer, K.; Phildius, J.; Seifritz, W. (Eidgenoessisches Inst. fuer Reaktorschung, Wuerenlingen (Switzerland)). 1974. 14p. Dep. NTIS (US Sales Only) $4.00.

From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

The investigations demonstrate that a routine on-line reac-

tivity meter can be built on the basis of the zero-crossing correlation method. It may be integrated into normal reactor instrumentation as a safety device to monitor subcritical states or the instantaneous reactivity during a slow approach to critical. The application is not restricted to reactors with slow kinetics. It can also be designed for fast reactors since the zero-crossing correlation technique is generally applicable. However, it should be emphasized that its main potential is directed to slow kinetics systems (D_2O-moderated or graphite-moderated systems) where other noise methods fail. (auth)

15642 (CONF-741065-11) MEASUREMENTS OF KINETIC PARAMETERS BY NOISE TECHNIQUES ON THE MINERVE REACTOR. Carre, J. C.; Costa Oliveira, J. D. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France); Junta de Energia Nuclear, Sacavem (Portugal). Lab. de Fisica e Engenharia Nucleares). 1974. 18p. Dep. NTIS (US Sales Only) $4.00.

From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

The results of experiments on the ERMINE core proved that the pile noise theory with a point kinetic model, is sufficient for application to zero power reactors. The neutron lifetime obtained by correlation of the neutron signals of two ion chambers, or the position recopy of control rods are in good agreement with the results obtained by the Rossi α method and reactivity modulation experiments. The power spectral density in reactivity used as an excitation in the reactor model may be used for the study of various applications. The interpretation of measurements is easy with this block diagram: reactor with feedback, auto power spectral density on the control rod, etc. (auth)

15643 (CONF-741065-14) STOCHASTIC STUDY OF COUPLED REACTOR SYSTEMS. Genoud, J. P. (Ecole Polytechnique Federale, Lausanne (Switzerland)). 1974. 10p. Dep. NTIS (US Sales Only) $4.00.

From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

The neutron behavior of two loosely coupled reactor cores is calculated on the basis of a stochastic formulation and compared with neutron noise measurements made in the FMRB research reactor. (LTN)

15644 (HEDL-TME-71-87) WDC-1-1 EXPERIMENT DATA PACKAGE. Pitner, A. L. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Jun 1971. Contract AT(45-1)-2170. 20p. AT.

Detailed specifications for an irradiation effects test of boron carbide (WDC-1-1 experiment) in the ETR are given. This material has a potential application in fast reactor control rods. (LTN)

15645 (HEDL-TME-74-33) FFTF FISSION GAS DELAY BEDS: ENGINEERING SCALE TEST. Final Report. Kabele, T. J.; Bohringer, A. P. (Hanford Engineering Development Lab., Richland, Wash. (USA)). 1973. Contract AT(45-1)-2170. 13p. AT.

The dynamic adsorption coefficient of ^{85}Kr on activated charcoal from a nitrogen carrier gas was measured at -80 and -120°C at pressures of zero and 30 psig. The effects of the presence of impurities in the nitrogen carrier gas (1% oxygen, and 100 vppm carbon dioxide) on the adsorption coefficient of ^{85}Kr were also measured. Measurements on the dynamic adsorption coefficient of ^{133}Xe on activated charcoal from a pure argon carrier gas were completed. These measurements were made at -100°C and at pressures of zero and 25 psig. Earlier results of this program were reported in HEDL-TME 73-26. (auth)

15646 (SLA-74-0105) ANNULAR CORE PULSE REACTOR (ACPR) REACTOR KINETICS. Estes, B. F.; Morris, F. M. (Sandia Labs., Albuquerque, N. Mex. (USA)). Dec 1974. Contract AT(29-1)-789. 16p. Dep. NTIS $4.00.

An analytical model has been developed which combines the nuclear and thermal characteristics of the Annular Core Pulse Reactor (ACPR) into a solution describing both the neutron kinetics of the reactor and the temperature behavior of a fuel-moderator element. The model describes both pulse and steady-state operations. Important aspects of the reactor and the fuel-moderator elements, the neutron kinetic equations of the reactor, and the time-temperature behavior of a fuel-moderator element being subjected to the maximum power density in the core are described. Some solutions which demonstrate the versatility of the model are given. (auth)

15647 (WANL-TME-1095(Rev. 2)) FINAL TEST SPECIFICATIONS FOR A STRUCTURAL MATERIALS TEST TO BE CONDUCTED AT THE PLUM BROOK REACTOR(37/W402). Coombe, J. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). May 1966. 1p. Dep. NTIS.

15648 (WANL-TME-1145) PRELIMINARY TEST SPECIFICATION FOR DOSIMETRY TEST EXPERIMENT RE-3. Rothleder, B. M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 19 Apr 1965. 5p. Dep. NTIS $4.00.

Specifications are provided for a test to determine the spacial and energy distribution of the neutron flux in a capsule located in the Plum Brook reactor. The environment, neutron flux, gamma flux, duration, power level, temperature, pressure and location in the reactor are specified along with the test procedure. (LTN)

15649 (WANL-TME-1146) PRELIMINARY TEST SPECIFICATION FOR AN ORGANIC MATERIALS IRRADIATION TEST TO BE CONDUCTED AT THE PLUM BROOK REACTOR (37/W301). Blinn, H. O. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 28 Apr 1965. 8p. Dep. NTIS $4.00.

Specifications are provided for an irradiation test of organic sealants and cements (500°F, 130 psi, 3.2×10^{13} n/cm^2-sec fast neutron flux, 1.4×10^{14} n/cm^2-sec thermal neutron flux (maximum values), 5.38×10^{10} ergs/gm(C)-hr gamma dose rate (total gamma dose 3.0×10^{11} ergs/gm(C)), duration 5.57 hours, environment helium gas with 3% hydrogen and 60°F dewpoint). (LTN)

15650 (WANL-TME-1393) STRUCTURAL MATERIALS EXPERIMENT 37/LA01/2 IRRADIATED AT PLUM BROOK REACTOR FACILITY, PBRF CYCLE 44. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Mar 1966. 27p. Dep. NTIS $4.50.

Sixteen metallurgical samples (alloys and brazing procedures are given) in a test fixture were irradiated in HT-1 of the Plum Brook reactor (with thermocouples and dosimeters) for 582 MW days at a former level of about 60 MW. The samples were exposed to the cooling water at temperatures varying between 125 and 150°F. After irradiation the samples were sent to Los Alamos for post irradiation examination. The materials were being evaluated for potential use in reactor core structural brazed joints for the phoebus reactor. (LTN)

15651 (WANL-TME-1399) RE-3 NEUTRON FLUX MEASUREMENT IN HT-1 OF THE PLUM BROOK REACTOR PBRF CYCLE 40P. Blinn, H. O. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Mar 1966. 26p. Dep. NTIS $4.50.

Neutron fluxes were measured in the water-filled W2-3 irradiation capsule located in HT-1 (horizontal tube No. 1) of the Plum Brook reactor at 60 mw power. Most of the dosimeters consisted of the following: a quartz-encapsulated, bare aluminum-cobalt wire and a cadmium-covered aluminum-cobalt wire for the thermal and epi-thermal flux measurements, and a quartz encapsulated sulfur pellet to measure the fast flux. The dosimeters were exposed for 5.75 hours and the measured fluxes are believed to be within ±15 percent. Since the power level was known to ±5 percent, the flux data should be known to less than ±20 percent. The position of each dosimeter was known to about $\frac{1}{4}$ inch. The flux spectrum approximated a normal fission spectrum, at least between 1.5 and 2.9 MeV. There was a sharp decrease in neutron flux beyond 13 inches from the core mid plane, i.e., the decrease corresponded to the edge of the core. Thermal neutron flux at the center was $2 \text{ to } 3 \cdot 10^{14}$ n/cm^2-sec, epi-thermal 1 to $8 \cdot 10^{12}$ and fast flux 6 to $8 \cdot 10^{12}$, depending somewhat on control rod positions. (LTN)

15652 (WANL-TME-1418) OPERATOR QUALIFICATION GUIDE FOR W-1 CRYOGENIC LOOP. Experiment No. 62-16. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Apr 1966. 65p. Dep. NTIS $6.25.

Information required for, and the procedure for qualifying personnel for, operation of the W-1 Cryogenic Loop of the Plum Brook Reactor facility is given. A detailed working knowledge of the whole system is required and includes the thermodynamics and principles of operation. The manual will be supplemented by lectures and on the job training. Written and oral examinations will be followed by interview by a qualification board. Emphasis is given to hazards and emergency conditions and knowing the procedure for several complex operations. (LTN)

15653 (WANL-TME-1477) PRESSURE TRANSDUCER EXPERIMENT No. 23/R511 IRRADIATED AT THE PLUM BROOK REACTOR FACILITY. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 9 Aug 1966. 36p. Dep. NTIS $5.00.

Standard controls Corp. and Statham pressure transducers and cable assemblies (AGC) were irradiated in the Plum Brook reactor to determine the effects of nuclear radiation heating. In the first

part of the experiment the transducers were exposed up to their rated operational temperatures; in the second part internal temperatures were allowed to exceed maximum operational values to determine operability and/or damage thresholds. Test specifications, equipment, procedure, neutron flux and accumulated data are given without conclusions or summarization. (LTN)

15654 (WANL-TME-1524) TRANSIENT TEMPERATURE ANALYSIS OF IRRADIATION TEST CAPSULE. Burwell, D. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 17 Oct 1966. 28p. Dep. NTIS $4.50.

Protection of the Plum Brook cryogenic irradiation test capsule from excessive temperature during emergency conditions is discussed. The maximum cryogenic helium loop operating temperature (capsule inlet helium temperature), which is dictated by capsule excessive temperature protection, is determined. Loss of cryogenic helium flow or refrigeration will result in capsule overheating and consequent damage if emergency actions are not taken to keep capsule temperatures below 400°F. Three emergency actions (capsule withdrawal, emergency helium flow, and reactor fast setback) are studied, using the TOSS code, to determine which ones and which combinations of them provide adequate capsule protection. The operational sequence recommended is capsule withdrawal at 40 inches/minute by itself and emergency flow plus setback, the latter combination to be used in case withdrawal fails. Under these conditions, the maximum capsule inlet helium temperature is limited to 170°R. (auth)

15655 (WANL-TNR-110) EXPERIMENT DESIGN MANUAL AND HAZARDS ANALYSIS PLUM BROOK REACTOR FACILITY. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1 Jul 1966. 325p. Dep. NTIS $19.25.

A design manual and hazards analysis is presented for an in-pile cryogenically-cooled capsule in the HT-1 tube of the Plum Brook Reactor Facility (PBRF) and for its associated flow system. It will be used in an irradiation effects test program in support of NERVA to provide a high flux, low temperature environment. Changes necessary on or before July 1, 1966 are included. (auth)

15656 AUTOMATIC CONTROL EQUIPMENT OF THE TR-O REACTOR. Frystacky, J.; Kult, L. Nukleon; No. 4, 6-11(Dec 1973). (In Czech).

Information is presented on the automatic control equipment of the Tr-O reactor. The equipment provides for the attainment and stabilization of criticality, for power control by a cadmium rod or by the D_2O level, and for continuous monitoring and the transmission of warning signals. Information is also given on coarse and fine level meters and on the process computer ESTIMATOR used in the mapping of the reactor neutron flux. (auth)

15657 THE TRAINING REACTOR SUR OF SIEMENS. Szirmai, E. (Dept. of Nuclear Hematology and Radiation Biology, Institute of Nuclear Science, Stuttgart, GE); Partel, G. (Centro Studi Trasporti Missilistici, Roma IT). Ingegneria; 11: 565-570(1973). (In Italian).

The physics fundamentals and the facilities of the training reactor "SUR" are described in detail. The "SUR" is a thermal, solid homogeneous reactor using U_3O_8 enriched with ^{235}U as fuel and polyethylene as moderator. The control is made by two Cd plates; the power level is 100 MW. The reactor can be used for training or testing purposes or as a radiation source. (INIS)

Production and Materials Testing and Processing Reactors

Refer also to abstract 15737.

Propulsion and Package Reactors

Refer also to abstracts 13942, 13943, 13986–13989, 14218, 14219, 14231–14234, 14687, 15648–15650, 15738–15743, and 15777–15790.

15658 (WANL-EOM-004) EDDY CURRENT TESTER. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 11 Nov 1963. 34p. Dep. NTIS $4.75.

The Eddy Current Tester, NERVA project, WANL Part No. 799D587, is described. It is used for the inspection of the fuel element flow holes in pre-operational, interim, and post-operational tests of fuel elements. During flow tests it is used after every even numbered test. It is a key instrument in cold flow tests and essential to checking the mechanical reliability of fuel elements with speed and accuracy. It locates the position of a flaw accurately. By use of an alarm level the element of operator's judgement is eliminated. Any discontinuity in the conductivity of a fuel element will produce a signal. This may be a chip or groove in the coolant channel, or a crack, void, hard spot impurity in the fuel element material. Points producing large signals after having previously passed inspection are probably cracks that have developed. The extent of a crack can be determined by probing other coolant channels near a channel in which a defect has been located. (auth)

15659 (WANL-EOM-027) OPERATING PROCEDURES FOR THE WANL DEMODULATOR SYSTEM ISFS - 720. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jun 1966. 46p. Dep. NTIS $5.50.

The model 9111 Demodulator is a six channel carrier type amplifier demodulator system that uses external carrier power. By having a single frequency for a multi-channel system, the usual problems of cross talk and carrier beats are avoided. Gain and bandwidth characteristics of the unit make it possible to operate the unit at carrier frequencies from 3 KC to 10 KC at voltage levels of 5 volts to 10 volts rms. Full scale output of the equipment is 10 volts DC for input sensitivities from 25 millivolts to 1 volt rms. Various controls have been incorporated for adjustment of gain, phase, full scale calibration, zero, and variable output. Accuracy of the unit is within ±0.5 percent of full scale output. This system can operate with any three- or four-wire variable reluctance or linear variable differential transformer transducers. (auth)

15660 (WANL-TME-517) TESTS OF CROSS COUPLING BETWEEN DIAGNOSTIC TRANSDUCER CIRCUITS. Merchant, C. C.; Swope, R. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 20 Sep 1963. 31p. Dep. NTIS $4.75.

The diagnostic instruments to be used in the NRX tests were tested under the actual conditions to be found during test in the NRX reactors. In addition to qualifying each transducer to survive under the environmental conditions found in NRX, the transducer should be tested under conditions which include identical cables and cable length, preamplifier, signal conditioning equipment, amplifiers, grounding techniques, and proximity to other transducer circuits. By duplicating the data system, grounding techniques and proximity to other transducers, it should be possible to locate and solve problems which would otherwise not be brought to the surface until the instruments are tied into the data system at the test site. Tests have been conducted to determine if any cross coupling will occur between LVDT circuits and other transducer circuits in close proximity. The results of tests conducted with strain gage, thermocouples, accelerometers, and pressure transducers indicate that no cross coupling can be expected if proper grounds are maintained. All cable sheaths and shields and signal conditioning equipment should be maintained at common ground potential. (auth)

15661 (WANL-TME-527) THE DESIGN OF NEUTRON DETECTORS FOR NERVA. Austin, W. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 30 Sep 1963. 60p. Dep. NTIS $6.00.

Design parameters of ion chambers and fission counters are discussed and these relationships used to produce improved neutron detector designs suitable for control of NERVA. Three detectors and detector systems are required for coverage of the ten or more decades of fission power. Improvements obtained for the power range detector, which is a gamma compensated ion chamber, include: inherently less gamma response (obtained by using beryllium metal as the electrode structural material); an optimum boron thickness (for a maximum neutron sensitivity with cylindrical chambers); the relative neutron and gamma response (as a function of the gas pressure in an ion chamber. A figure of merit is derived for the most efficient design); voltage adjustable gamma compensation (more precise over a wide range of gamma intensities than previous designs). Improvements in the intermediate range fission counter include: a long plateau for stability and fast electron collection which provides additional gamma pileup discrimination and a higher count rate capability. A standard type fission counter design is probably suitable for the startup detector. (auth)

15662 (WANL-TME-532) TEST SERIES B 3, SINGLE SEAL LOW PRESSURE ISOTHERMAL TEST. Bauserman, G. W.; Jacob, W. L.; Steffen, R. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 30 Oct 1963. 15p. Dep. NTIS $4.00.

An experiment to determine preliminary qualitative air flow coefficients past the support segment in the lateral support system of the NERVA Reactor was carried out on a small plexiglass model by varying conditions of pressure and configuration. The

results show that the flow coefficients are affected by configuration consistent with predictions. The apparent anomalies are undoubtedly the result of uncontrolled leakage in regions other than across the support bar. The results with any group are reasonably consistent. The loss coefficient analysis also shows reasonable consistency, although deviation from a constant value for each configuration is evident. The coefficient is strongly affected by the configuration. No unexpected results occurred due to the general make-up of the seal system. Model leakage increases with continuing rig assembly and disassembly, hence erroneous results will prevail and misleading data be obtained unless a more durable model is designed and built. (auth)

15663 (WANL-TME-561) WANL FUEL MATERIAL IRRADIATION PROGRAM, CAPSULE SERIES T–T (PHASE I). Addendum IV. Thermal Stress Analysis. Jacobs, D. C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). [nd]. 3p. Dep. NTIS $4.00.

A thermal stress analysis of fuel radiation capsules, made from Type 316 stainless steel, shows that there is no danger of rupturing the capsule by induced thermal stresses during normal operation (inside temperature 299°F, outside temperature 203°F, wall thickness 0.031″). (LTN)

15664 (WANL-TME-794) EFFECT OF MIST FLOW ON COOL-DOWN TEMPERATURES AND COOL-DOWN TIME. Chi, J. W. H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 22 May 1964. 30p. Dep. NTIS $4.50.

An experimental study on the cool-down of aluminum test sections by liquid hydrogen has been carried out. Film boiling occurs approximately 90% of the cool-down time. The dominant mechanism of two-phase flow observed is mist flow. A cool-down model was proposed and equations derived for the prediction of cool-down wall and fluid temperatures at any time and location. The experimental wall temperature histories correlated well within experimental errors, and cool-down times were calculated with a standard deviation of ± 9.5%. The equations permit estimations of cool-down time as well as wall and fluid temperatures at any time and distance along the channel provided that the two-phase fluid is in mist flow. (auth)

15665 (WANL-TME-805) PRESSURE TRANSDUCERS EXPERIMENT No. 23/W505 IRRADIATED AT PLUM BROOK REACTOR FACILITY PBRF CYCLE 16P. Llewellyn, E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 25 May 1964. 26p. Dep. NTIS $4.50.

Candidate pressure transducers for NRX-A reactor service were irradiated and dynamically tested in the HT-1 facility of the Plum Brook reactor at a power level of approximately 50 MW. The sample fixture was exposed to an average water temperature of 127°F and an average pressure of 127 psig. The test was prematurely terminated after 18 hours (745 MW-hr) with only 2 of the 5 units still operative and these two had a pronounced zero shift. (LTN)

15666 (WANL-TME-821) ANALYSIS OF CHECK VALVE 578. Failure and Recommendations. Gahagen, F. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 11 Jun 1964. 6p. Dep. NTIS $4.00.

During the NRX-A1 test series, check valve 578 failed (Pacific Valve, Trim No. 12K, 600 lb. cast steel, bolted bonnet, swing check valve, flanged ends, size 6″). The failure was first indicated by a high pressure drop across the check valve during a nitrogen flow test. An examination of the check valve by a re-entry team found that the disc stud had failed, freeing the disc (flapper) and allowing it to be lodged in the discharge port thus restricting flow. Inspection of the valve revealed that the failure occurred at the last thread. An evaluation was requested on the suitability of this type valve for the intended service. Crane's Technical Paper No. 410, pp. 2–7, states that most of the difficulties encountered with swing check valves have been found to be due to oversizing which results in noisy operation and premature wear of the moving parts. This statement applies very well to valve 578. Operations personnel indicates that there was low resistance to flow and an audible chattering traceable to valve 578 with small gas flows. This was during facility checkouts when personnel were present in the FCR. The chattering is further substantiated by excessive wear on the hinge pin which was evident upon inspection of the valve's internal parts. This is the first such reported failure of a Pacific check valve. A defect in the material that did not show up during Pacific nondestructive testing evidently caused the failure under the influence of cyclic loading. Analysis of the fractured part was not possible because the upper part of the disc stud could not be found, and the lower part of the stud was destroyed in the process of making the disc usable for the remaining scheduled tests. (auth)

15667 (WANL-TME-835) NERVA CANDIDATE BALL-BEARINGS IRRADIATED AT PLUM BROOK REACTOR FACILITY CYCLE 6 (PB No. 2W). Cadoff, H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 19 Jun 1964. 26p. Dep. NTIS $4.50.

Irradiation tests of Candidate NERVA control drum bearings, conducted at the Plum Brook Reactor Facility are described. The purpose of this experiment was to determine possible physical changes in the bearing resulting from the irradiation. The results indicate a significant increase of friction after irradiation. This is not as expected from previous work. The surface condition of the bearing, which may to some degree have been influenced by the radiation environment, was at least partially responsible for this. This increase in friction could also have been a result of chips of the retainer becoming lodged in the bearing. Chipping of this retainer can be seen in the post-irradiation photographs. The lubricant composite, however, is a developmental material and as such may differ significantly from batch to batch. Also, the sample shapes in this test and the previous materials test differ significantly. Since compacting is a part of the manufacturing process and die shape is an important variable of manufacture, shape of the resultant part may affect the material. Further testing under dynamic and full load conditions is indicated to determine causes of these variations. (auth)

15668 (WANL-TME-845) TIE ROD VIBRATORY STRESSES OBSERVED DURING NRX-A1 COLD FLOW TESTS. Warner, P. C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 Jul 1964. 12p. Dep. NTIS $4.00.

During the NRX-A1 cold flow tests vibratory stress signals of appreciable levels were recorded by the tie rod strain gages. Investigation of the validity of these signals led to the conclusions that no such stresses actually existed; that is that the signals were not real data but were cross-talk from other channels. Modifications have been made to the instrumentation to eliminate these extraneous signals in the NRX-A2 test series. (auth)

15669 (WANL-TME-1109) NERVA PROGRAM. Test Engineering Test Plan Book. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Apr 1965. 105p. Dep. NTIS $8.25.

Brief descriptions of potential reactor and/or engine tests are provided to assist in the planning of future nuclear subsystem test programs. Included are tests which are firmly or tentatively assigned to particular reactor test programs, test which have been proposed for reactor test programs, and tests which conceivably may be of value in the future. The 54 test descriptions are arbitrarily divided into seven categories as follows: low power tests, power tests, reactor dynamic and steady-state tests, controls tests, safety tests, component tests, and engine-type closed loop tests. Since many tests logically fit into more than one category, cross-referencing indexes have been included. (auth)

15670 (WANL-TME-1110) INSTRUCTIONS FOR NRX-A4 REACTOR-IN-VESSEL ASSEMBLY AT WANL. Schaedel, C. T. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 23 Feb 1965. 19p. Dep. NTIS $4.00.

Assembly instructions are provided for installing the NRX-A4 reactor into the pressure vessel at WANL. These instructions cover operations involved from the time that the pressure vessel is received at WANL until it is secured in the shipping container and ready for shipment, with emphasis on the steps that will be followed during operations which interface with the pressure vessel and closure during assembly. (auth)

15671 (WANL-TME-1112(Add.1)) PRELIMINARY MODEL EQUATIONS NRX/EST AND XE ENGINE SIMULATOR NUCLEAR INSTRUMENTATION. Mackey, L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 3 Jun 1965. 9p. Dep. NTIS $4.00.

Equations necessary to simulate the tie rod exit gas temperature, reactor decay heat, and average in-core structural graphite temperature are presented. The tie rod exit gas temperature is required since the reactor may be controlled on this temperature or it may be used as a control variable for a limiter. The reactor decay heat is necessary in order to simulate the cooldown characteristics and the equation for any average in-core structural graphite temperature is required since it has not been determined what station temperature will be used for control. (auth)

15672 (WANL-TME-1128) WANEF ANNUAL OPERATIONS REPORT, 1964. Barksdale, C. E.; Kovacik, W. P. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Mar 1965. 20p. Dep. NTIS $4.00.

The results of criticality experiments on the PAXA and PAXB critical assemblies are described. The experiments involved initial criticality, control drum worths, reactivity shimming, power distribution, reactivity coefficients of core and reflector materials, and reactivity worths of poison wires (used for safety in shipping). (LTN)

15673 (WANL-TME-1129) DATA ACCURACY LIMITS FOR NRX-A3 AND TCA INSTRUMENTATION. Lance, J. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 19 Mar 1965. 44p. Dep. NTIS $5.25.

An accuracy evaluation of NRX-A3 and NRDS Test Cell "A" instrumentation has been carried out. Included are narrow band data channels, wide band data channels, transducer accuracy limits, estimated overall system accuracy and accuracy evaluation of computed parameters. (auth)

15674 (WANL-TME-1130) DESCRIPTION OF THE DIGITAL ANALYSIS PROGRAMS USED TO ANALYZE THE WIDE BAND TEST DATA. Killinger, A. H.; Saalbach, C. P.; McCune, W. C.; Kocur, R. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Aug 1965. 135p. Dep. NTIS $9.75.

The digital computer programs which were written at WANL to process the wide band (0 to 1000 CPS) NERVA test data are described. These programs are the SPIT Program, PLOT Program, and the AUTOCT Program. The input to the SPIT Program is a packed digital tape produced by the WANL Wide Band Data Converter. The SPIT Program performs calibration, tests for linearity of the data recording system, unpacks and converts the voltages from the A-D tape to values with engineering units, calculates interim time values, and generates a magnetic tape containing the time and channel values for the requested time slices. The Plotting Program uses the data generated above to produce a tape which may be plotted on the Stromberg Carlson 4020 electronic plotter. The AUTOCT Program generates a tape with the requested data in a form acceptable to the Huntsville Correlation Program for spectral analysis of the data. (auth)

15675 (WANL-TME-1134) WANL CALIBRATIONS FOR NRX/EST. Burlas, T. C.; Karako, E. F.; Farabaugh, A. W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1 Jun 1965. 81p. Dep. NTIS $7.25.

Detailed instructions are provided for the calibration of thermocouples, calorimeters, pressure transducers, linear variable displacement transformers, and all other WANL instrumentation installed on the NRX/EST reactor. (LTN)

15676 (WANL-TME-1140(Rev.A)) NRX SERIES AND XE SERIES REACTOR SHIPPING PROCEDURE BETWEEN WANL, LARGE, PA., AND NRDS, JACKASS FLATS, NEVADA. Cartwright, B. D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA) Astronuclear Lab.) 20 Apr 1966. 42p. Dep. NTIS $5.25.

The personnel requirements, equipment, methods, and procedures for shipping NRX Series and XE Series reactors are described. The responsibilities and duties, equipment requirements, operation and maintenance, security requirements, safety requirements, and data acquisition procedures for the combined rail and tractor-trailer shipments of NRX Series and XE Series reactors between WANL–Large, Pennsylvania, and NRDS–Jackass Flats, Nevada are specified. (auth)

15677 (WANL-TME-1140(Rev.B)) NRX SERIES AND XE SERIES REACTOR SHIPPING PROCEDURE BETWEEN WANL, LARGE, PA., AND NRDS, JACKASS FLATS, NEVADA. Cartwright, B. D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 20 Dec 1966. 42p. Dep. NTIS $5.25.

15678 (WANL-TME-1140(Rev.C)) NRX SERIES AND XE SERIES REACTOR SHIPPING PROCEDURE BETWEEN WANL-LARGE, PA., AND NRDS-JACKASS FLATS, NEVADA. Cartwright, B. D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 1967. 43p. Dep. NTIS $5.25.

15679 (WANL-TME-1140(Rev. D)) NRX SERIES AND XE SERIES REACTOR SHIPPING PROCEDURE BETWEEN WANL-LARGE, PA., AND NRDS-JACKASS FLATS, NEVADA. Cartwright, B. D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Apr 1968. 42p. Dep. NTIS $5.25.

The personnel requirements, responsibilities and duties, equipment requirements, operation and maintenance procedures, security requirements, safety requirements, purge requirements, and data acquisition procedures for the combined rail and tractor-trailer shipments of NRX Series and XE Series reactors between WANL-Large, Pennsylvania, and NRDS - Jackass Flats, Nevada, are presented. (auth)

15680 (WANL-TME-1143) OPERATION ANALYSIS OF WAFF GAMMA SCANNING SYSTEM. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). May 1965. 38p. Dep. NTIS $5.00.

The operational characteristics of the production gamma scanning system at the Westinghouse Astrofuel Facility are described. This system is essentially a duplication of a system originally developed at the Los Alamos Scientific Laboratory, Los Alamos, New Mexico. The purpose is to measure the uranium loading concentration and uniformity in uranium-graphite fuel elements for the NERVA Project manufactured by the Astrofuel Facility. It was found that a reasonable stability (about 1 percent long term–one hour monitor required) can be achieved over normal working day periods by modifying the original WAFF Scanning System. Additional modifications were necessary to substantially increase effective spectrum resolution which resulted in increased definition. These modifications yield increased system precision and reliability. Some system drift was found as the detector is not in a stable environment. (auth)

15681 (WANL-TME-1152) REACTIVITY COUPLING OF CLUSTERED NERVA REACTORS. Mowery, A. L.; Romesburg, C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 14 Apr 1965. 46p. Dep. NTIS $5.50.

The coupling magnitude of two reactors is conveniently separated into three factors. The first is the number (and spectrum) of neutrons leaving the "driver" reactor per fission in the driver core (leakage factor). These neutrons attenuate across space to the driven core (geometrical attenuation factor). The incident neutrons are converted to fissions in the driven core (effectiveness factor). The coupling in terms of reactivity, δk, is $\delta k = (1 - k_{driven})$ fission rate produced in the driven core by the driver core/fission rate in the driver core. The models of the cores and the calculational systems used to calculate these factors are delineated in Appendix II. The leakage factor was readily obtained from transport theory criticality calculations on the reactor. Geometric attenuation was based on neutron transport in free space. The effectiveness of neutrons incident on the driver core was determined by the "iterated fission probability" and was checked by the straightforward "shell source" method. For NERVA I and NERVA II systems, the coupling is approximately $0.5¢$ for NERVA I and $0.25¢$ for NERVA II at 33 feet separation. The coupling is much larger at closest separation; $\sim 45¢$ for NERVA I and $\sim 10¢$ for NERVA II. An interesting result that can be immediately derived from the coupling is the steady state power produced in a shutdown driven core if the driver core is operating at full power. This case would arise if the startup of a clustered array were performed sequentially, i.e., one is brought to full power before the startup of the second engine is initiated. The steady state driven core power is a non-trivial amount of power (order of MW) even at 33 feet separation distance. (auth)

15682 (WANL-TME-1220) STATUS REPORT ON MODELS FOR NRX AND ENGINE SYSTEMS ANALYSIS. Stock, A. H.; Buker, J. C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 29 Jul 1965. 39p. Dep. NTIS $5.00.

The status in July, 1965 of the various analog and digital computer systems analysis models available for use in NRX and engine systems and control studies at WANL is summarized. Descriptions of various changes made to models which were in existence at the time the last status report are described as well as new models and techniques which have been developed. Model development work has been done in CY '65 in several specific areas as follows: 1. The analog computer power range model has been updated. 2. A model has been developed to represent two phase heat transfer. 3. An EST feedsystem simulation has been developed. 4. An analog computer one-console model has been developed for the purpose of studying NERVA-II clustered engine dynamics and for analyzing slow profiles. The model can be used for NERVA-I studies as well. 5. The SAM/TNT code has been developed and used to establish the current analog EST model. The model is being extended to operate in the subpower range and with various input conditions. 6. Several linearized models have been developed and coded for the digital computer for use in obtaining quantitative frequency response data on the various analog models without requiring time consuming measurements on the analog computer. 7. Comparisons have been made between NRX operating data and analog computer power range model predictions. Both the NRX-A2 and -A3 power tests have been used to evaluate the accuracy of the analog computer models. (auth)

15683 (WANL-TME-1226) PERFORMANCE ANALYSIS OF THE WIANCKO AX-44 VARIABLE RELUCTANCE ACCELEROMETERS USED ON THE NRX-A3 REACTOR. Pappas, T. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 23 Jul 1965. 25p. Dep. NTIS $4.25.

Results of the performance analysis conducted on two developmental model Wiancko AX-44 variable reluctance accelerometers installed on the forward flange of the NRX-A3 reactor are presented. Analysis of all of the tests revealed that both units functioned in accordance with design predictions. Vibration data recorded was well correlated with GH_2 and LH_2 flow conditions.

Furthermore, analysis of the data plus a post-run examination revealed no signs of damage or gross deterioration of the accelerometers. (auth)

15684 (WANL-TME-1231) ANALOG COMPUTER MODEL FOR SIMULATION OF TWO PHASE FLOW HEAT TRANSFER IN THE NERVA REACTOR NOZZLE. Rovnak, J. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 26 Jul 1965. 29p. Dep. NTIS $4.50.

An analog model of the reactor nozzle has been developed for the simulation of bootstrap startups and power range operation. The chilldown period during bootstrap and operation with two-phase flow are simulated using empirical correlations developed from experimental chilldown studies. The model was used to simulate chilldown of the NRX-A1 reactor and feedline, and the results compared well with available data. Bootstrap startups with the three-console analog NERVA system model have been successfully simulated. (auth)

15685 (WANL-TME-1234) COMPUTER METHODS FOR ANALYSIS OF NRX-A3 DATA. James, L. R.; Wolsko, T. F. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 27 Jul 1965. 49p. Dep. NTIS $5.50.

Computer methods utilized in the processing and analysis of NRX-A3 data are given. The procedures are presented and the digital computer codes are described, placing emphasis on the flexibility of the wideband data processing system. Selected data processed for the NRX-A3 tests are presented for illustrative purposes. (auth)

15686 (WANL-TME-1239) PRELIMINARY TEST SPECIFICATION FOR NEUTRON DETECTOR TEST TO BE IRRADIATED AT THE PLUM BROOK REACTOR (21/W003). Bush, N.; Rothleder, B. M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 17 Aug 1965. 11p. Dep. NTIS $4.00.

Test specifications are provided for the evaluation of the performance of the Westinghouse Type WX5406 Fission Counter and RMS Log Power Amplifier system over a range of neutron flux similar to what will be experienced in NERVA Engine or NRX reactor applications. Detailed test procedures are specified for the irradiation in the Plum Brook reactor. (LTN)

15687 (WANL-TME-1249) NON-NUCLEAR QUALIFICATION TESTING OF STRAIN GAGE TYPE DIFFERENTIAL PRESSURE TRANSDUCERS FOR SHIELDED APPLICATION. Simoncini, M. V. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 19 Aug 1965. 35p. Dep. NTIS $4.75.

Non-nuclear qualification testing was performed on CEC and Statham unbonded strain gage type differential pressure transducers. Statham Models PL 749 and CEC Models 172550 are acceptable for test-car-mounted, shielded application during NERVA tests. The Statham transducer is the more accurate differential pressure transducer for NERVA applications. CEC transducers display zero shifts with change of pressure media and with high line pressure. Selection of units is required to provide ±2% measurement accuracy. The CEC 4-351 and Statham PM 280 TC oil-filled high line pressure transducers are unacceptable for NERVA application in the pressure transducer panels by reason of radiation or temperature environmental problems. Improved procurement requirements can by evolution provide further improvements in Models PL 749 and 172550 transducers. (auth)

15688 (WANL-TME-1394) OPERATIONAL MANUAL AND ACCEPTANCE TEST PROCEDURE FOR WANL ETS-1 POWER INCREASE TIMER MODEL 937J845G01. Hardies, C. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 4 Mar 1966. 50p. Dep. NTIS $5.50.

The WANL ETS-1 power increase timer is a self-contained, transistorized, electronic measuring device which provides a readout of the period required for the reactor power increase to exceed a preset increment (which may be $\epsilon = 2.718$, but can be set to other values). The period can be between 0.1 and 100 seconds (i.e. fast response) and, after the readout (possibly remote), the equipment is automatically reset at the new power level and the operation repeated. The equipment is described in detail, with theory of operation, specifications, alignment procedure, maintenance and repair data, acceptance tests and interconnection diagrams. (LTN)

15689 (WANL-TME-1396) OPERATIONAL MANUAL FOR ETS-1 TSCS PRINTOUT SWITCHING CHASSIS. Bartholomew, R. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 4 Mar 1966. 25p. Dep. NTIS $4.25.

The Printout Switching Chassis of the ETS-1 Test Stand Control System provides switching functions and auxiliary circuitry for the Printout Switching System. Depending on switch position, any one of three functions (FUNCTION ANALYSIS, POWER INCREASE-TIME, or LOG POWER) can be printed. Several auxiliary requirements are taken care of: signal amplitude limiting or level correction, DC rejection, transfer function analyzer requirements, BCD reference voltage signals, run-stop control of printer, on-off switches, etc. The chassis has no contained power supplies and all power is obtained from external sources. Installation, operation, maintenance and acceptance tests are described. (LTN)

15690 (WANL-TME-1409) OPERATIONAL MANUAL FOR COMPONENT CHASSIS LRE CONSOLE. Kowalcheck, H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 21 Mar 1966. 36p. Dep. NTIS $5.00.

The manual covers the LRE component chassis mounted at the rear side of the LRE console. The chassis contains fuses and various auxiliary equipment, components and power modules associated with the LRE Console front panels and half of the ATE front panels. Operation, maintenance, test and acceptance procedures are given. (LTN)

15691 (WANL-TME-1410) NRX-A5 TRANSDUCER STATUS REPORT. Chambers, G. M.; Figenbaum, E. K. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Apr 1966. 42p. Dep. NTIS $5.25.

Some 200 transducers for NRX-A5 tests have been obtained to meet engineering specifications with no restrictions. Thermocouples, pressure transducers, accelerometers, vibration transducers, calorimeters, etc. were involved. To maintain an unclassified status, some parts numbers are omitted and a scrambled code or other documents are required to relate the measurement numbers of core instrumentation to installation and assembly drawings. In many cases part no. and vendor serial no. are given with the letter and number identification of reference documents needed to define the part. (LTN)

15692 (WANL-TME-1417) NRX-A5 TEST PARAMETER LIMITS JUSTIFICATION. Christenson, J. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). May 1966. 11p. Dep. NTIS $4.00.

The justification for the selection or establishment of parameter limits in the NRX-A5 test specifications is presented with supporting references. Some temperature limits were chosen to prevent melting, creep, deterioration, cracking, etc. of components and others to ensure safe operation. Similarly, certain pressure limits were chosen for proper operation of essential systems. If some limits were exceeded such as excessive power, loss of control drum supply power, certain flow conditions, etc. test shutdown would take place automatically. These limits were set sufficiently high to avoid spurious or inadvertant shutdown yet low enough to ensure adequate reactor protection and prevent fission product release. (LTN)

15693 (WANL-TME-1445) ERROR BAND LIMITS FOR WANL MEASUREMENTS ON NRX-A5. Moran, M. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 23 Jun 1966. 112p. Dep. NTIS $8.75.

Using data taken during instrument calibration, 99 percent confidence intervals have been calculated for a wide range of values for all Westinghouse-supplied transducers used in the NRX-A5 test series. Three curves are shown: the transducer error band, the data system error and the total system error. The latter are root mean square combinations of the first two types of errors (assumed independent of each other). Computer programs are given. (LTN)

15694 (WANL-TME-1454) NRX-A5 INSTRUMENTATION PORT QUALIFICATION TESTS. Edmiston, J. M. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jun 1966. 35p. Dep. NTIS $4.75.

The instrumentation port in earlier WANL test reactors depended on a physical deformation of a metal ring to seal the interface of the instrumentation capsule to the pressure vessel. A new sealing technique employing a brazed joint at the juncture was proposed for the NRX-A5 reactor. The evaluation of this port configuration along with an alternate improved mechanical seal design is the subject of this memorandum. Both instrumentation port configurations met all the test requirements specified by the design group and described herein. (auth)

15695 (WANL-TME-1461) OPERATIONAL MANUAL AND ACCEPTANCE TEST PROCEDURES FOR ETS-1 10 CHANNEL AVERAGERS. Model 936J154G01 (ECS), Model 936J154G01 (TSCS). Grimm, D. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Nov 1966. 175p. Dep. NTIS $11.75.

The chassis is described with parts specifications and schematic diagrams. The theory of operation is given and also alignment procedures, maintenance and repair data, acceptance tests, etc. (LTN)

15696 (WANL-TME-1463) NRX/EST CONTROL SYSTEM PERFORMANCE. Final Report. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1966. 79p. Dep. NTIS $6.75.

The majority of the control systems operated well and as predicted. Most of the anomalies were due to component failures. One exception was power controller oscillations during autostart and under short period conditions due to reactor short period effects. This was corrected by a design change. Another exception was instability in the pressure controller attributed in part to an incompatibility between the engine dynamic response and the analog model response. Two alternate methods of controlling nozzle chamber temperature were tested. Both methods control the reactor control drums directly without using an internal power control loop. These new concepts for controlling temperature offer several advantages. System performance from a strict controls point of view is improved. Programming requirements are simplified and improved tracking performance results. Both methods simplify the reactor control system so fewer components are required and improved system reliability results. If system improvements, either in weight or reliability, can be realized by an on-off actuator, this is a feasible method of controlling the reactor. All factors considered, the control systems performed well and maintained a suitable level of controllability and safety. (auth)

15697 (WANL-TME-1597) SYNTHESIS OF CALCULATIONAL METHODS FOR THE DESIGN AND ANALYSIS OF RADIATION SHIELDS FOR NUCLEAR ROCKET SYSTEMS. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 7 Mar 1967. 126p. Dep. NTIS $9.50.

Calculational methods for the design and analysis of radiation shields for nuclear rocket systems are presented. These methods include the TRANSPORT, POINT KERNEL, and MONTE CARLO methods. Comparisons of data calculated by each of the three methods with available experimental data from the NERVA Reactor program are presented. (auth)

15698 (WANL-TME-1763) NRX-A6 WIDE BAND DATA PLAYBACK REPORT. Moran, M. J.; Weldon, T. P. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Feb 1968. 24p. Dep. NTIS $4.25.

The results of a study of NRX-A6 full power test wide band data from the standpoint of the recording system are presented. The user of wide band data is provided with a guide for interpretation of data shown on oscillograph playbacks. The observations are identified with recorder and recorder tracks for ready reference. An appendix of the wide band measurements listing identifying data tracks, ranges, etc. is provided along with an NRX-A6 chronological test profile as a further aid to data analysis. In addition, the format for the time code is presented. (auth)

15699 (WANL-TME-1876) ERROR BAND LIMITS FOR WANL MEASUREMENTS ON XE-2. Moran, M. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Nov 1968. 131p. Dep. NTIS $9.75.

Error band limits have been calculated for the Westinghouse-supplied transducers used in the XE-2 test series. Three curves were calculated: the transducer error band, the data system error band and the total system error band (the latter being the root-mean-square combination of the first two errors, i.e. assuring independence). The confidence level used was 99 percent, but this level cannot be guaranteed in every case because the number of samples was not always large enough. (LTN)

15700 (WANL-TME-1914) RADIATION ENVIRONMENT IN VARIOUS REACTOR COMPONENTS. Final Report. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1970. 228p. Dep. NTIS $14.50.

The radiation environment was measured in the core and reflector of the PAX/G reactor assembly, which provides preliminary radiation information characteristic of the graphite-fueled R-1 reactor. The results include neutron flux densities obtained with sulfur ($E > 2.9$ MeV), U-238 ($E > 1.5$ MeV), bare and cadmium-covered Dy ($E < 0.4$ eV). Fast neutron dose rates from Phylatrons and gamma dose rates from CaF_2 thermoluminescent dosimeters and from Bragg-Gray ion chambers were also determined. Results were compared with analytical calculations based on a similar reactor model. Normalization factors to be applied to the calculational techniques were statistically determined along with 1σ standard deviations for use in the R-1 design. Good agreement was obtained for the gamma dose rate from TLD's and for the fast flux ($E > 1.5$ MeV). Reasonable agreement was obtained for the fast neutron dose rate. The agreement obtained for fast neutron flux ($E > 2.9$ MeV), for thermal flux ($E < 0.4$ eV), and for Bragg-Gray dose rate was somewhat poor. These differences can be explained in part by the differences between the experimental and analytical models and further investigations are planned to resolve the remaining differences. (auth)

15701 (WANL-TME-1940) SPRVIB. A General Purpose Dynamic Computer Code Using Normal Mode Solution. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jun 1971. 167p. Dep. NTIS $11.50.

A new general dynamic computer code called SPRVIB (Spring Vib) was developed at Westinghouse Astronuclear Laboratory in support of the NERVA (Nuclear Engine for Rocket Vehicle Application) Program. Using normal mode techniques, the program computes kinematical responses of a structure caused by various combinations of harmonic and elliptic forcing functions or base excitations. Provision is made for a graphical type of force or base excitation input to the structure. Either proportional or modal damping is allowed in the structure. A description of the required input format and a listing of the program are presented along with several examples illustrating the use of the program. SPRVIB is written in Fortran IV computer language for use on the CDC 6600 or the IBM 360/75 computers. (auth)

15702 (WANL-TME-2678) CONTROL DRUM ACTUATOR DESIGN CONCEPTS (U). (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Apr 1970. 210p. Dep. NTIS $13.50.

A detailed trade study of design concepts for the Control Drum Actuator System, a component of the NERVA Nuclear Subsystem (NSS), is presented. The purpose was to evaluate and select the most logical and reasonable approach for continued detailed design and development, consistent with the programmatic and technical requirements for the ten-hour full-flow cycle engine as defined in the NERVA Program Requirements Document. The functional and technical requirements were identified by the December, 1969, Systems Engineering draft of the component specification, EC 677585. Alternate design concepts were evaluated with the selection of the recommended design concept in each area based upon the construction of a comparison matrix. Each alternate was evaluated on the basis of performance, physical characteristics, and reliability, with particular emphasis upon the severe environmental requirements. The permanent magnet stepping motor design, incorporating epicyclic transmission and drive shaft center spring Actuator Malfunction Override Device (AMOD), was the concept selected and recommended for continued detail design and development. The major factors leading to this selection are described. (auth)

15703 (WANL-TME-2691) STRUCTURAL SUPPORT COOLANT VALVE ACTUATOR. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). May 1970. 217p. Dep. NTIS $14.00.

Eleven actuator concepts for application as a Structural Support Coolant Valve Actuator (SSCVA) and one single system concept as a complete structural Support Supply System are evaluated. The 11 actuators are either pneumatic or electric and the single system concept is fluidic. Conceptual drawings are included for each concept. Failure mode analysis, fault tree analysis and safety analysis are performed on each concept. In addition, qualitative evaluations are made by WANL structural, thermal and radiation disciplines. A comparison matrix is included to summarize pertinent information about each concept. Selected parameters such as weight, reliability, safety, experience and performance are used to select one concept of each type as the recommended approach. Westinghouse recommends a Permanent Magnet Rotor Electric Stepper Motor as the electrically-operated selection and a Single Piston Rack and Pinion as the pneumatically operated selection. Because of the anticipated future potential of an all-fluidic SSCVA system, Westinghouse further recommends that continuing assessment and development be carried out to determine its applicability and merits. (auth)

15704 (WANL-TME-2692) PAX-G2 FISSION FLUX DISTRIBUTION MEASUREMENTS. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jun 1970. 31p. Dep. NTIS $4.75.

An experiment was performed to assist in prescribing the R-1 fuel loading distribution. This experiment provided a measured radial fission density (detailed) distribution in the PAX-G2A reactor for use in power analysis calculations. The PAX-G2A reactor has an R-1 size core (larger than NRX-A/PAX-E series and no inner reflector) and a 60-degree mockup of the current R-1, 18-control drum configuration in the beryllium reflector. This reactor mockup differs from the earlier version PAX-G1A, as reported in WANL-TME-1917, principally by the redistribution of TaC uniformly to the core periphery instead of only to a radius of 36.4 cm. The experimental procedure utilized U-Al wires located at the core midplane to determine the measured radial

fission density distributions and included the self-shielding effects of the U-Al wires previously measured and reported in WANL-TME-1911. The comparison of the PAX-G2A to PAX-G1A fission distribution measurements shows the desirability of uniformly distributing the TaC shims to the core periphery. This uniform distribution is recommended for use in the R-1 design due to the small power perturbations caused at the core periphery. The difference between the experimental and calculated fissions/gram at the core periphery is on the order of 25 percent. The scatter of the NC_i correlation factors at the periphery is due to the fact that the measured data explicitly take into account effects of the irregular periphery and the interaction between elements, whereas the calculated fissions/gram use a model with a smooth periphery and homogenized fuel regions. The calculated peripheral power scalloping due to the control drums can cause an azimuthal variation in the NC_i's. A comparison of the NC_i's from PAX-G0 and PAX-G2A indicates that PAX-G2A data are preferable in setting the preliminary R-1 loadings due to the fact that they apply more adequately to an 18-control drum system. (auth)

15705 (WANL-TME-2694) WANEF ANNUAL OPERATIONS REPORT, 1969. Tobin, J. P. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). May 1970. 25p. Dep. NTIS $4.25.

The PAX/R-1 critical assembly was operated for most of 1969, but late in the year the control console was connected to the Flexible Critical Experiment (FCX). The experiments included initial criticality, control drum worths, reactivity shimming, power distribution, reactivity coefficients of core and reflector materials, dosimetry measurements and reactor shutdown measurements and each is described briefly. Training, safety, hazards analysis and emergency procedures were emphasized. (LTN)

15706 (WANL-TME-2699) OPTIMIZATION OF P_c FOR NSS. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jun 1970. 20p. Dep. NTIS $4.00.

WANL trade study 717 evaluated the effects on the Nuclear Subsystem (NSS) and its components of varying rated chamber pressure from 300 to 600 psia for the ten-hour, full-flow engine for both nominal twin Turbo Pump Assemblies (TPA) and malfunction single TPA operation. After considering fuel element corrosion, hot end support creep, reliability, weight and developmental risk, two NSS recommendations were made. For a dual-pump engine design, where operation at rated conditions with one pump failed is not required, a 550 psia chamber pressure is recommended. If operation is required at rated conditions with one pump failed, then 450 psia represents the best compromise for all NSS parameters involved. (auth)

15707 (WANL-TME-2700) NERVA STRUCTURAL SUPPORT COOLANT ASSEMBLY CONCEPT SELECTION. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1970. 47p. Dep. NTIS $5.50.

Three valve arrangements for controlling flow to the Structural Support Assembly (SSA) and to the SSA bypass have been evaluated to compare various concepts considering: (A) flow division between SSA and SSA bypass during operating time, (B) valve requirements and arrangements, and (C) functional and emergency requirements. Two of these concept studies used three-way valves for flow control with design such that total flow through the system remained constant for all valve angles. One of these concepts (A) had a minimum SSA flow orifice; the other did not. The third concept used conventional two-way flow control valves (total flow was not constant) and had a minimum SSA flow orifice. Concept A was selected since it offered a safety advantage, provided constant total flow and had added operational flexibility during engine cool-down. (auth)

15708 (WANL-TME-2726) NERVA MANAGEMENT PLAN. Volume III. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 30 Sep 1970. 66p. Dep. NTIS $6.50.

A detailed Nerva management plan depicts the total plan in gross terms. Section 2 contains the Tier 1 diagram which expands on these functions and serves as a road map for the detailed functions shown on the Tier 2 diagrams. Section 3 contains the Tier 2 diagrams which depict the detailed functions and documents for the plan. A legend explains the functional numbering codes and the placement of document titles and block numbers relative to each of the functional blocks. The diagrams show a general constraint flow path by the lines and arrows which indicate a logical sequence of functional events rather than strict constraint lines. Reference blocks are used to minimize redundancy and indicate that a functional path may be reiterated. (auth)

15709 (WANL-TME-2730) NERVA REACTOR MATERIALS PROGRAM PLAN. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1970. 50p. Dep. NTIS $5.50.

The procedures and the guidelines to be used at the Westinghouse Astronuclear Laboratory (WANL) to obtain materials properties data, materials process data, and materials development information adequate for use in design are defined. (auth)

15710 (WANL-TME-2731) GRAPHITE FOIL SET TEST. Final Report. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1970. 48p. Dep. NTIS $5.50.

Graphite foil laminates are used in the NERVA reactor as insulation on the core side of the reflector. This insulation is pressed between the lateral support seal segments which are supported by ledges projecting from the I. D. of the reflector. Knowledge of the compression characteristics (set, deflection, and spring constant) of the graphite foil insulator, which is determined in this test, is required in order to determine the size of the lateral support components and to determine the effect on the dynamic analysis of the lateral support. Three insulation thicknesses were evaluated in this test: .035, .050, and .080 inch. Both deflection and set characteristics were studied for temperatures ranging from room temperature up to 2000°R and pressures ranging from 25 psi to 6000 psi. It can be concluded from this test that the graphite foil laminated insulation in thicknesses up to .080 inch can be utilized in the R-1 reactor without significantly affecting the displacement or dynamic characteristics of the lateral support system. (auth)

15711 (WANL-TME-2732) CLUSTER ATTACHMENT SEAL LEAKAGE TEST. Final Report. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1970. 97p. Dep. NTIS $8.00.

Three types of seals are used in the attachment of the cluster hardware to the support plate in order to contain the SSCA hydrogen flow. These O-rings, grafoil seals, and metal-to-metal seals were tested under varied laboratory conditions. Data obtained were used to predict the leakage for the NERVA reactor under rated conditions. The predicted leakage was compared with the Cluster Hardware Specification No. EC-677558 requirements for leakage. Each seal, when assembled to proposed reactor assembly conditions, was found to be capable of meeting the sealing requirements. Required seating forces or seating torques were determined for each seal. (auth)

15712 (WANL-TME-2741) TEST SUPPORT EQUIPMENT, AEROSPACE GROUND EQUIPMENT PLAN, R-SERIES SUPPORT EQUIPMENT. Volume II. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1970. 175p. Dep. NTIS $11.75.

15713 (WANL-TME-2754) STRUCTURAL ANALYSIS REPORT, NUCLEAR SUBSYSTEM. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Feb 1971. 325p. Dep. NTIS $19.25.

Structural analyses are presented to derive and establish the performance and design requirements for the NERVA Subsystem and its Engineering Critical Components. This establishes and substantiates the appropriate parameters of the selected design and provides the source for steady state and transient structural data. Included are applicable specifications relevant to the structural design, a description and derivation of analytical models and methods, the maturity of the input data, the validity of the analytical methods, and the interpretation and analysis of the resulting steady state and transient data. (auth)

15714 (WANL-TME-2757(Vol. 1)) RADIATION AND SHIELDING ANALYSIS REPORT, NUCLEAR SUBSYSTEM. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Feb 1971. 720p. Dep. NTIS $39.00.

Steady state and transient radiation and shielding data were calculated for the NERVA nuclear subsystem to provide support for the derivation of appropriate performance and design requirements. Fast, intermediate and thermal neutron fluxes and neutron spectra were calculated at selected internal and external locations for various conditions of operation. Similarly, the gamma radiation and photon spectra were calculated. Finally the radiation heat deposited and the heating rate in each reactor region were calculated. Detailed results are presented. (LTN)

15715 (WANL-TME-2757(Vol. 2)) RADIATION AND SHIELDING ANALYSIS REPORT, NUCLEAR SUBSYSTEM. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Feb 1971. 413p. Dep. NTIS $23.75.

The Radiation and Shielding Analysis of the NERVA NUCLEAR SUBSYSTEM (NSS) and its Engineering Critical Components (ECC) are documented. This constitutes the primary source of all steady state and transient radiation and shielding data. The detailed

Radiation and Shielding Analysis consisted of the following: support for the derivation and establishment of appropriate performance and design requirements for the NSS and its ECCs. Establishment and substantiation of the appropriate parameters of the selected design. (auth)

15716 (WANL-TMI-356) NRX-A1 CORE GRAPHITE SEAL. Parsons, L. E. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 30 Oct 1962. 20p. Dep. NTIS $4.00.

Leakage rates of gaseous hydrogen were obtained for ATJ, HLM, and ZTA graphite at room temperature at various pressure differentials. One-half inch specimens were tested and the data was transformed to read pounds of hydrogen per second per square inch of area per inch of thickness. Rates decreased from HLM to ATJ to ZTA respectively. The permeability varied from sample to sample and with the grain direction. A test of hydrogen flow through two discs with non-aligned through-slots demonstrated that overlapping segments of graphite can be expected to seal. Results indicate ZTA graphite be used for the graphite seal with flow designed to be parallel to the grain. (auth)

15717 (WANL-TMI-556) INFORMAL OUTLINE OF REACTOR PHYSICS PROGRAM. Drawbaugh, D. W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 8 Mar 1963. 5p. Dep. NTIS $4.00.

15718 (WANL-TMI-2003) XE-PRIME XENON MEASUREMENTS, CHAPTER E. XE-Prime Test Analysis Report. Ortenberg, L. I.; Mowery, A. L.; Rittenberger, R. V. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Feb 1970. 15p. Dep. NTIS $4.00.

The ability to restart a nuclear reactor at some time following powered operation is dependent in part on the negative reactivity worth of the fission product inventory at the time of restart. Of special importance are those products with both a large absorption cross section and/or a large total fission yield. The most serious poison of such products is xenon-135 (approximately 9.17 hr half-life), which has the largest known cross section (3.6×10^6 barns for 2200 meter per second neutrons) and a direct fission yield of 0.237 percent but a total fission yield of 6.41 percent (i.e. from the whole chain and most of this from iodine 135). Measurements of the negative reactivity have been made at 2.8, 7.3, 22.8 and 30.2 hours after the EP-5C power test and compared to analytically calculated values with reasonable agreement but subject to some uncertainty due to large corrections and uncertain error estimates. An accurate analytical model for the xenon effect is required to design the NERVA reactor control system with sufficient drum span to override the xenon effect for each of the burns in the planned mission. (LTN)

15719 (WANL-TNR-079) OPERATION SUPPORT PLAN. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 21 Dec 1962. 61p. Dep. NTIS $6.25.

The operations that must be performed in preparation for the NRX-A1 test series are presented in chronological sequence. The equipment required in these operations is specified. Many of the operations involve transport of the reactor, with emphasis on precautions, testing before use, etc. Performance testing operation of the reactor is not included here and post-operative examination and disposal sections have not been firmed up yet. (LTN)

15720 (WANL-TNR-083) TANK HEATING CODES TIC-TOC AND TOE FOR THE IBM 7090 COMPUTER. Woodsum, H. C.; Heiser, P. C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jan 1963. 59p. Dep. NTIS $6.00.

Two codes, TIC-TOC and TOE, have been formulated for a 32 K IBM-7090 Computer in order to calculate integrated heating, heating distributions and temperature rise in the hydrogen propellant contained in the propellant tank of a NERVA vehicle produced by incident reactor radiation. TIC-TOC calculates the temperature rise vs. operating time for two fluid flow models, the heating distributions, and the integrated heating in the liquid hydrogen propellant for 3 group neutron and gamma reactor equivalent point sources. TOE calculates the heating density in the hydrogen from n,γ reactions. The approximate running time for TIC-TOC is 1 minute per case while that of TOE is about 1 minute per receiver point or about 20 minutes for a complete map of the secondary gamma heating distribution. (auth)

15721 (WANL-TNR-099(Add.)) SAFETY REPORT FOR THE WESTINGHOUSE ASTRONUCLEAR EXPERIMENTAL FACILITY. Frantz, F. S. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jun 1966. 9p. Dep. NTIS $4.00.

An auxiliary, manual, shutdown system has been designed and constructed for the PAX reactor to provide a "last ditch" capability of cancelling the positive reactivity insertion associated with the maximum credible accident. Two complete and independent units operated by 12 volt batteries and consisting of a poison (12 lbs of B_4C in each unit) storage hopper, gear motor, dump valve, flexible stainless steel discharge tube and a discharge nozzle which discharges the poison granules into the annulus between the outer and inner reflectors. One of these units will shut the reactor down in less than a minute. Some special features designed to ensure reliability are described. (LTN)

Reactor Safety and Environmental Aspects

Refer also to abstracts 13773, 14011, 14014, 14019–14023, 14025–14028, 14031, 14033, 14039–14041, 14043–14047, 14054, 14060–14064, 14068, 14069, 14074, 14077, 14081, 14082, 14098, 14099, 14102–14106, 14110, 14406, 14420, and 14421.

15722 (AI-AEC-13139) NUCLEAR SAFETY CHARACTERIZATION OF SODIUM FIRES AND FAST REACTOR FISSION PRODUCTS, JULY–SEPTEMBER 1974. Quarterly Technical Progress Report. (Atomics International Div., Canoga Park, Calif. (USA)). 1974. Contract AT(04-3)-824. 16p. Dep. NTIS $4.00.

Studies on the characterization of sodium fires and fission products include sodium splash dispersal tests, the development of the SOMIX computer code, and radiological consequences of an FFTF hypothetical core disassembly accident. (DCC)

15723 (CONF-730611-18) DIVERGENT PUBLIC ATTITUDES TOWARD NUCLEAR AND HYDROELECTRIC PLANT SAFETY. Gast, P. F. (Argonne National Lab., Ill. (USA)). Jun 1973. 17p. Dep. NTIS $4.00.

From 19th annual meeting of the American Nuclear Society; Chicago, Illinois, USA (10 Jun 1973).

The benefits and risks from hydroelectric and nuclear power plants are compared. On the basis of the history of dam failures, it is concluded that the probability of a major dam failure is of the order of 1×10^{-4} per dam year (due to rock slides, slides along fault planes, exceptional floods, etc.). The consequences of such a failure are estimated to be of the order of 1000 deaths and $200 million damages. Thus the probability of such a major dam failure is greater than estimates of the probability of a major nuclear plant disaster and the consequences are smaller, but approach that of a hypothetical major nuclear plant disaster. The fact that the public is more worried about a nuclear disaster is hypothesized to be due to (1) the public not believing estimates of the probability and consequences of a nuclear disaster based only on analysis and inference, (2) dams are more readily understood, so the public has confidence in dam engineers, and (3) that non-zero risk from dams exists only for populations in areas downstream from the dams while the number of beneficiaries is much greater. (LTN)

15724 (CONF-741065–8) CORRELATION ANALYSIS OF THE ENVIRONMENTAL INFLUENCES ON THE RADIOACTIVE ARGON RELEASES FROM THE PLUME OF THE REACTOR DIORIT. Behringer, K.; Feuermann, D.; Kostic, L.; Seifritz, W. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). 1974. 25p. Dep. NTIS (US Sales Only) $4.25.

From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

During a one-month period the influence of meteorological variables (e.g., wind speed, wind direction, vertical temperature gradient) on the gamma dose rate emitted from the plume of the 25 MW(t) heavy water reactor DIORIT was studied. Stochastic methods and multiple regression analysis were used. A simple model which consists of a linear superposition of the various effects on the dose rate was assumed. The time records of the dose rate, wind speed, wind direction and vertical temperature gradient show the typical characteristics of a nonergodic, nonstationary process. Therefore, a corresponding analysis technique had to be applied. Mean values, standard deviations, covariance functions, partial and multiple correlation coefficients were calculated using the ensemble averaging technique. (auth)

15725 (CONF-750108-1) BONSAI: CULTIVATING THE LOGIC TREE FOR REACTOR SAFETY. Rubel, P. (Oak Ridge National Lab., Tenn. (USA)). 1975. 14p. Dep. NTIS $4.00.

From annual reliability and maintainability symposium; Washington, District of Columbia, USA (28 Jan 1975).

Practical aspects of adapting tree logic to analysis of reactor plant safety are discussed. Emphasized is the desirability of incorporating fundamental and engineering information into trees

of accident events, in order to improve general understanding of accident risks and to stimulate dialogue on safety issues. The organization strategy combines decision and fault trees, and proposes substituting a matrix format for the decision tree in some applications. Example diagrams consider the HTGR cooling interruption accident. (auth)

15726 (GA-A-13183) SAFETY-RELATED RESEARCH AND DEVELOPMENT PROGRAMS CITED IN SECTION 1.5 OF HTGR PSARs. Biannual Report for Period Ending July 31, 1974. Tully, G. R. Jr.; Stiehl, G. L. Jr. (General Atomic Co., San Diego, Calif. (USA)). 15 Nov 1974. 46p. (GA-LTR-101).

Research and development programs described include: core seismic program; test of core support posts; primary coolant moisture monitor test program; control rod drive test program; and core auxiliary cooling system component design verification development, and qualification tests. (DCC)

15727 (KFK-2050) FIRST SEMIANNUAL REPORT, 1974. (Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Nukleare Sicherheit). Aug 1974. 279p. (In German). Dep. NTIS (US Sales Only) $17.00.

Separate abstracts are presented for each of the five sections concerning environmental impact of nuclear power stations and reprocessing plants, system behavior of nuclear plants during incidents, distribution and reaction processes of nuclear containments in major incidents, confinement and elimination of the consequences of incidents, and safety assessment of nuclear plants. (DCC)

For abstracts of individual sections see: 15728–15732.

15728 (KFK-2050, pp 70-128) ENVIRONMENTAL IMPACT OF NUCLEAR POWER STATIONS AND REPROCESSING PLANTS. Aug 1974. (In German).

Experimental work is described concerning the development of filters and offgas systems; release, transport, and deposition of fission products in reactor circuits and their decontamination; long-term radiological environmental burden; and separation of krypton and xenon from the offgas of nuclear installations. (DCC)

15729 (KFK-2050, pp 129-230) SYSTEM BEHAVIOR OF NUCLEAR PLANTS DURING INCIDENTS. Aug 1974. (In German).

Experimental work is described concerning the dynamic load of components and systems; emergency core cooling of water–cooled reactors; and core meltdown of water–cooled reactors. (DCC)

15730 (KFK-2050, pp 231-244) DISTRIBUTION AND REACTION PROCESSES OF NUCLEAR CONTAMINANTS IN MAJOR INCIDENTS, THEIR DEPENDENCE ON TIME AND THEIR MEASUREMENT. Aug 1974. (In German).

Experimental work is described concerning the time dependent distribution and reaction processes of fission products and aerosols in the atmosphere and hydrosphere following major incidents. (DCC)

15731 (KFK-2050, pp 245-269) CONFINEMENT AND ELIMINATION OF THE CONSEQUENCES OF INCIDENTS. Aug 1974. (In German).

Information is presented concerning the isolation and removal of contaminations, and techniques of clearing and dismantling. (DCC)

15732 (KFK-2050, pp 270-274) SAFETY ASSESSMENT OF NUCLEAR PLANTS. Aug 1974. (In German).

Information is presented concerning the risk and reliability analysis of nuclear plants. (DCC)

15733 (LA-5821-MS) PROPOSAL FOR ANALYSIS OF HTGR CORE RESPONSE TO SEISMIC INPUT. Bennett, J. G.; Dove, R. C. (Los Alamos Scientific Lab., N. Mex. (USA)). Dec 1974. Contract W-7405-eng-36. 18p. Dep. NTIS $4.00.

The scaling laws that govern the physical modeling of a high temperature gas-cooled reactor (HTGR) core are formulated and methods for step-by-step development and verification of both physical and analytical models are discussed. The analytical method is shown to be feasible and some one-dimensional results for a simple parameter study in problems involving impacting blocks are given. 4 references. (auth)

15734 (MRR-139) PROBLEMS IN THE ANALOG MEASUREMENT OF FAST TRANSIENTS. Maier, H. D. (Technische Univ. Muenchen, Garching (F. R. Germany). Lab. fuer Reaktorregelung und Anlagensicherung). Jun 1974. 82p. (In German). Dep. NTIS (US Sales Only) $7.25.

First, the most important measurement devices currently used in reactor safety research are discussed from a system-theoretical point of view. Sufficiently exact substitutional transfer functions for all measurement components are given. By this means it is possible to estimate the expected dynamical behavior of a measurement component. In the second part methods of correcting or diminishing (on-line or off-line) the dynamic error created by the dynamic behavior of the measurement chain are discussed. (auth)

15735 (NP-20261) RESEARCH ON REMOVAL OF IODINE BY CONTAINMENT SPRAYS CONTAINING TRACE LEVELS OF HYDRAZINE. Final Report. Reid, D. L.; Johnson, B. M.; Postma, A. K. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jun 1974. Contract 212B52000. 95p.

Four large scale experiments were conducted to determine the effectiveness of boric acid sprays containing 50 ppm hydrazine for removal of iodine from containment atmospheres. For three of these experiments, iodine was released as a simulated burst prior to spraying. Spraying was intermittent over an 8 hr period at an isothermal temperature of 280°F for one test and at 150°F for two tests. The fourth test simulated the temperature-pressure decay (from 280°F) of sprayed containment vessels following a LOCA. Iodine was released over a 1 hr period during continuous spray operation. The fresh spray water contained 1500 ppm boric acid and 50 ppm hydrazine for all tests. The iodine partition coefficients were greater than 10,000 and 100,000, for the instantaneous and pseudo equilibrium coefficients, respectively. The 2 hr dose reduction factor projected from these results was approximately 15 assuming a 4 percent cutoff for "nonreactive" species. It is worth noting that in these experiments less than 0.1 percent of the injected iodine was airborne as "nonreactive" species. These large scale proof tests demonstrated that sprays containing trace levels of hydrazine were as effective for absorbing airborne iodine as had been indicated from earlier equilibrium studies. (auth)

15736 (UCRL-75854) APPLICATION OF THE FAULT TREE TECHNIQUE TO A NUCLEAR REACTOR CONTAINMENT SYSTEM. Cummings, G. E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 13 Nov 1974. 23p. (CONF-740906-6). Dep. NTIS $4.25.

From conference on reliability and fault tree analysis; Berkeley, California, USA (3 Sep 1974).

A fault tree analysis of a pressurized water reactor containment system is described. The analysis is used to determine the probability of excessive leakage of containment atmosphere following a loss-of-coolant accident. Emphasis is placed on the preliminary steps taken to make the analysis of such a large, complex system manageable. The final result is a reduced fault tree which describes only the main failure paths and to which component failure rate data can be applied to obtain a quantitative result. (auth)

15737 (UNI-SA-8) REACTOR OPERATIONAL SAFETY. Bolliger, J. R. (United Nuclear Industries, Inc., Richland, Wash. (USA)). 30 Sep 1974. Contract AT(45-1)-1857. 5p. (CONF-741081-1). Dep. NTIS $4.00.

From thermal power conference; Pullman, Washington, USA (4 Oct 1974).

The safety philosophy, safety features, and operational procedures of the N-Reactor are described. (DCC)

15738 (WANL-TME-796(Vol. 2)) WANL SOURCE TERM PROGRAM STATUS REPORT, VOLUME II OF II. Brown, W. S. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). May 1964. 196p. Dep. NTIS $13.00.

A computer program capable of calculating the source strength of radioactive debris on the earth's surface resulting from the re-entry of reactor fragments following operation of a nuclear powered rocket vehicle is described. The factors that must be considered in evaluating the radiological hazards associated with the radioactive material are described in Volume 1. The WANL Source Term Computer Program is written in FORTRAN II for the IBM 7094 computer. The program calculates (1) the resultant velocity and re-entry angles imparted to core fragments by an explosive destruct action, (2) the fragment's orbit lifetime and re-entry time to ground impact, (3) the mass loss of the fragment due to re-entry burnup, and (4) fission product inventory and gamma and beta energy source strength of the fragment at ground impact. The program is suitable for use in parametric studies where the relative hazards of many particles of different size and different initial orbit parameters must be evaluated. Up to 200 cases may be run in one set of problems, with no limit on the number of stacked sets of problems. Average machine running time is approximately 5–6 seconds per case. The present program is limited to the calculation of the fission product inventory of fragments of NERVA type fuel. Only normal reactor operations are considered and loss of fission products by diffusion is neglected. (auth)

15739 (WANL-TME-818) USE OF PVC-18 IN EMERGENCY COOLDOWN. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 9 Jun 1964. 6p. Dep. NTIS $4.00.

In the event of a nozzle or main propellent line failure during the NRX-A2 test, emergency coolant flow can be supplied only through the emergency purge line in the pressure vessel dome. The ambient GH_2 flow rates required for dome end cooling are shown in WANL-TNR-148 for various core exit temperatures. An analysis based on the flow requirements was performed and the results indicated that the maximum requirement of 25 lb/sec could be met with a PCV-18 upstream pressure of 3,000 psi. The analysis was extended to include a more conservative PCV-18 upstream pressure of 1,400 psi, as might be expected near the end of a test, and certain modifications of the emergency purge line were found to be necessary. (auth)

15740 (WANL-TME-1422) OPERATIONAL MANUAL FOR REACTOR SAFETY SYSTEM. Kowalcheck, H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 20 May 1966. 60p. Dep. NTIS $6.00.

The operational manual for the Reactor Safety System Chassis (identified only as being in Rack 63 at the Test Cell Bldg.) includes a description, acceptance and installation tests and procedures, principles of operation and maintenance suggestions. (LTN)

15741 (WANL-TME-1525) NUCLEAR SAFETY ASPECTS OF XE-1 CENTRAL POISON WIRE REMOVAL. Vachon, L. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 7 Nov 1966. 16p. Dep. NTIS $4.00.

The experience gained from prior reactor testing and the operational advantages that could be realized from earlier removal prompted a decision to withdraw all poison wires during the assembly phase of the NRX-A5 test program. Critical experiments were performed to develop procedures for safely removing the central poison wires from the core and for subsequent monitoring of reactor shutdown by a subcritical technique. Implementation of these procedures during the NRX-A5 test series confirmed the merit of these procedural safeguards. New procedural safeguards are described which will permit removal of the central poison system from the XE-1 reactor in the E-MAD facility and allow subsequent pre-test operations to be conducted without compromising the 2.0$ minimum shutdown requirement. The XE-1 reactor assembly will be transported by rail and delivered to the MAD facility with a full complement of poison wires (~7000 wires) which provides protection against all criticality hazards, including complete flooding. After installation the peripheral poison wires will be removed first with the drums full in. The 800 poison wires in the central core will provide a shut-down margin adequate to maintain a subcritical state under all conditions except flooding. Immediately before the test the central poison wires will be removed in defined increments with monitoring of the neutron count rate and calculation of the neutron multiplication between such removals and supplemented by measurement of single drum withdrawal effects between removals. Special precautions will be taken to avoid hydrogen insertion in the core, to minimize reflection including that by human bodies, shields, etc., and maintain the 2.0$ minimum allowable shut down margin. (LTN)

15742 (WANL-TME-1884) EVALUATION OF PROPOSED TEST CELL LINER MATERIALS AND A COLLIMATOR DESIGN. Huen, A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Dec 1968. 25p. Dep. NTIS $4.25.

Recent measurements of the radiation flux pattern above the PAX NERVA critical reactor with shield mockups having surface density >140 gm/cm^2 in place have indicated that the background radiation environment is considerably higher than the direct measured component. Experiments were carried out to evaluate methods to reduce the scattered and secondary radiations from the test cell walls by covering them with suitable materials and by surrounding the detector by a collimator. Also, the LASL collimator design was evaluated in a reactor environment. Gamma ray dose rate, thermal neutron flux density, and fast neutron flux density wall albedo measurements were made for the proposed test cell wall liner materials using the FCX reactor and a collimator from the Los Alamos Scientific Laboratory. The results indicate that, of the material combinations tested, the most effective wall lining materials for reduction of wall-produced radiation were as follows: (1) For gamma dose rate, $\frac{1}{4}$" lead +2" B-polyethylene; (2) For thermal neutrons, $\frac{1}{4}$" Boral +2" polyethylene +$\frac{1}{4}$" Boral; (3) For fast neutrons, 2" B-polyethylene. The respective wall albedos were 0.27 ± .03, 0.12 ± .01, and 0.45 ± .06. For a best compromise, a material sandwich, composed of $\frac{1}{4}$" lead, $\frac{1}{8}$" Boral and 2" lithiated paraffin, was tested and its respective albedos were 0.38 ± .04, 0.22 ± .02, and 0.65 ± .09 for the gamma rays and thermal and fast neutrons. A feasible supplement and/or alternative to lining the cell walls is the use of a detector collimator. Hence, the use of the LASL collimator for these experiments provides valuable experience and basic data which will aid in the future design of a collimator system to be used at WANEF. (auth)

15743 (WANL-TME-2727) NSS ANTICRITICALITY REQUIREMENTS FOR NERVA FLIGHT OPERATIONS. Trade Study No. 719. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1970. 41p. Dep. NTIS $5.25.

The requirements to prevent inadvertent criticality of the NSS during the time period from lift-off through final disposal of the NERVA flight engine are established. The core fragmentation and spatial dispersion that must be accomplished by action of the NERVA Anticriticality Destruct System in the event of abort during the boost phase were determined by analysis. Sources of accidental criticality of NERVA during space and mission operations are identified, potential countermeasures to prevent such accidents evaluated, and safety requirements for implementation of these countermeasures defined. The most significant sources of accidental criticality of the NERVA engine during space operations are inadvertent control drum roll-out and hydrogen insertion via an open flow path from the propellant tank into the core. The recommended anticriticality measures are an engine system design which (1) incorporates redundant safety features to preclude inadvertent control drum run-out and (2) reduces to a negligible level the potential for hydrogen insertion. The use of a poison wire system in space operation is not recommended because of the many difficulties associated with wire reinsertion in the core. (auth)

15744 ZEROING OUT FISSION-PRODUCT GASES. Pilmer, D. F. (Southern California Edison Co., San Clemente, CA); Thrall, G. M. Power (N.Y.); 118: No. 5, 82-84(May 1974).

A waste-gas treatment system in operation at the San Onofre nuclear power plant is described. Test results indicate that the cryogenic adsorption techniques employed in the system provide an economically and technically feasible method of reducing the activity levels of fission-product gases to near zero. (DG)

15745 EMERGENCY SURVEILLANCE AROUND A NUCLEAR REACTOR SITE. Palmer, G. H.; Perry, K. E. G. (Atomic Energy Establishment, Winfrith, Eng.). pp 301-312 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol. 1); CONF-731117-(P1).

Using filtration and delay beds the airborne radioactive discharges from a reactor system can, in normal operation, be reduced to a very low level. However there remains a low, but finite probability that in an accident situation a large release of airborne radioactivity could occur which might be of concern to nearby populations living in the district around the plant. The paper outlines the arrangements at a typical United Kingdom reactor site aimed at safeguarding the environment and the nearby population from the effects of any airborne activity released. A ventilation stack monitoring system is described which detects and helps to assess both the magnitude and composition of any gaseous discharge. In addition to providing a continuous sensitive indication of the wellbeing of the plant in normal operation, it can give a rapid early warning of a large release which might occur in an accident situation. Together with a supplementary emergency monitoring system, an early indication would be obtained of any release in order to initiate the emergency procedures. The organization set up by agreement between the site operators and the representatives of the local community will be described, where the relative responsibilities and control measures for safeguarding the nearby populations are outlined. These arrangements include those for rapid district monitoring, the monitoring and control of milk supplies, the possible temporary evacuation of people and, if need be, the medication of people who may have been exposed to an inhalation risk from ^{131}I. (auth)

15746 SOME CONSIDERATIONS OF THE EFFECTS OF THE ACCIDENTAL RELEASE OF FISSION PRODUCTS FROM REACTORS. Beattie, J. R. (United Kingdom Atomic Energy Authority, Culcheth, Eng.). pp 395-401 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353(Vol.1); CONF-731117-(P1).

Nuclear power reactors and their radioactivity confinement systems are designed, constructed, and operated so as to ensure, by the application of human ingenuity, knowledge, and experience,

that no uncontrolled release of radioactivity will occur. In normal operational conditions, radioactivity is discharged in gaseous and liquid effluents under controls which ensure that designated dose limits are not exceeded and that dose-rates are reduced as far below these limits as is reasonably practicable, bearing in mind costs and the importance of nuclear power. When all such requirements are fulfilled, there remains a finite if remote possibility of an accidental release of radioactivity to the atmosphere, which could adversely affect the health and safety of some of the public. Informed public opinion confirms this cautious view and is unlikely to be reassured except by reasoned argument. Plans for remedial action against the emergency following an unplanned radioactive release have been formulated in many countries, but may need revision as reactor development continues. This cannot be done without some fore-knowledge of the likely consequences of a release. Yet experience even from the few past accidental releases is limited, and relates to reactor types and accidents which may not be typical of present-day or future power reactors. However, such experience as has so far accrued may be combined with basic data such as fission yields, the physical and chemical properties of fission products and transuranic elements, evidence from experimental fuel tests and information regarding the radiological significance of the isotopes likely to be released. In this way forecasts can be made about radiation hazards to be countered and the relative levels of risk, should a release occur as a result of an accident, such as is conventionally assumed for a given reactor type. This evidence is reviewed in the paper, and deductions are made, for example about the radiological significance of isotopes other than iodine in future systems. The paper concludes by discussing with future systems mainly in mind, emergency surveillance and some remedial actions which might be put into effect. (auth)

15747 IEEE STANDARD FOR TYPE TESTS OF CONTINUOUS DUTY CLASS 1E MOTORS FOR NUCLEAR POWER GENERATING STATIONS. IEEE Standard 334-1974. New York; Institute of Electrical and Electronics Engineers, Inc. (1974). 16p. (ICONS-01925).

The basic requirements for equipment qualification are described. It requires that the qualification include the demonstration of the capability of the equipment, or the components thereof, to meet performance specifications under normal environments and under those conditions that cause and are caused by the design basis events for the station. Motors designed for use inside and outside the containment are covered. The intent is to provide guidance for the development of tests or analytical data adequate to demonstrate the capability of continuous duty Class 1E electric motors to perform their safety function. General requirements of both Class 1E electric motors and service conditions pertinent to nuclear power generating stations are discussed. Guidelines to insure uniformity in reporting data and to permit direct comparison of required and test values of all significant parameters are given. A chart of these parameters is required. Specific procedures and criteria applicable to qualifying motors are presented. (auth)

Reactor Theory and Calculation

Refer also to abstracts 15641, 15642, 15673, and 15717.

15748 (AEEW-R-921) RESONANCE ABSORPTION IN COMPLICATED GEOMETRIES. Roth, M. J. (UKAEA Reactor Group, Winfrith. Atomic Energy Establishment). Mar 1974. 30p. Dep. NTIS (US Sales Only) $4.50. UK 50 pence.

The spatial variation of resonance events is analyzed. A new method is described of calculating this in complicated geometries, being especially concerned with the variation across a pin. This method, known as the subgroup method, was first reported by Nikolaev and Khokhlov. A computer program, WRES, has been written using this new method and some results for it are given in comparison with more precise methods and with experiments. 30 references. (auth)

15749 (AEEW-R-966) WIMS-E MODULE W-SMEAR. Roth, M. J. (UKAEA Reactor Group, Winfrith. Atomic Energy Establishment). 1974. 32p. Dep. NTIS (US Sales Only) $4.75.

The input to the W-SMEAR module of WIMS-E is described. This module averages cross sections over space. Smearing of transport cross sections for the evaluation of leakage parameters may take account of neutron streaming, and the program offers a variety of alternative methods for correcting for this effect. Some flexibility is also offered in methods of normalising the cross sections. 7 references. (auth)

15750 (CONF-741065-4) THERMOELECTRICALLY GENERATED NOISE IN SHEATHED THERMOCOUPLES AND IN OTHER LOW LEVEL INSTRUMENTATION CABLES. Mathieu, F.; Meier, R.; Soenen, M.; Delcon, M.; Nysten, C. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)). 1975. 64p. (In French).

From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

Starting from the fact that thermoelectric emfs of thermocouples are generated in the thermal gradients and not at the hot junction, it is shown how thermoelectric heterogeneity in conjunction with natural and forced convection phenomena gives rise to unwanted noise called "thermoelectric noise" in the technological sense. A distinction is made between four different types of noise—i.e. uncorrelated noise, correlated noise, spectral noise and thermoelectric noise in the physical sense—each of which has its own characteristics. The experimental results reveal that noise amplitudes may be quite embarrassing when dealing with problems of quantitative signal fluctuation analysis. It is however emphasized that thermoelectric noise may also convey useful information which, without noise, might be lost. (auth)

15751 (CONF-741065-10) PLANT DISTURBANCE AND MODEL VERIFICATION. Butterfield, M. H.; Cummins, J. D. (UKAEA Reactor Group, Winfrith. Atomic Energy Establishment). Sep 1974. 20p. Dep. NTIS (US Sales Only) $4.00.

From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

Methods of measuring dynamic properties of reactors by injecting pseudo-random and other forms of disturbance are compared and examples quoted from zero energy and power reactor studies. The use of these disturbance measurements to verify mathematical models of the reactor and derive "best fit" values of parameters in the model is discussed. In general the set of best fit parameters depends on the criterion adopted. Criteria are proposed which relate directly to the intended use of the model and some corresponding results quoted. (auth)

15752 (CONF-741065-23) ANALYSIS OF AT-POWER NEUTRON FLUX NOISE IN THE FREQUENCY RANGE OF VIBRATING REACTOR STRUCTURES. Wach, D. (Technische Univ. Muenchen, Garching (F. R. Germany). Lab. fuer Reaktorregelung und Anlagensicherung). 1974. 34p. Dep. NTIS (US Sales Only) $4.75

From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

Reactor noise is more complex in power reactors than in zero power reactors. Several additional sources of noise (void or bubble transport, mechanical vibrations, detector problems, etc.) contribute a measurable amplitude at high power levels while at zero power the basic source is a neutron flux noise. The Fourier analysis of such noise at different power levels is a basic method for studying the source and significance of noise components. Further, the analysis of the noise picked up by several detectors in different locations usually shows that some components of the noise are correlated or common to several detectors but may vary in amplitude and some components are not correlated. By such studies it was determined that steam void transport was the main source of neutron noise for in-core chambers of the Lingen BWR. In contrast, core barrel movement (essentially vibratory movements of fuel and control rods) was the main source of neutron noise of ex-core chambers of the Siade PWR. (LTN)

15753 (CONF-741065-31) FUNDAMENTALS OF THEORETICAL ANALYSIS OF POWER REACTOR NOISE AND THEIR APPLICATIONS. Saito, K. (Hokkaido Univ., Sapporo (Japan). Faculty of Engineering). 1974. 40p. Dep. NTIS (US Sales Only) $5.00.

From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

The basic concepts and fundamental physical-mathematical methods which have been or may be used in due course for the theoretical analysis of power reactor noise are described. Then the results of some practical applications of the above concepts and methods are presented. (auth)

15754 (CONF-741065-33) THEORETICAL CONSIDERATIONS AND THEIR APPLICATION TO EXPERIMENTAL DATA IN THE DETERMINATION OF REACTOR INTERNALS' MOTION FROM STOCHASTIC SIGNALS. Thie, J. A. 1974. 16p. Dep. NTIS (US Sales Only) $4.00.

From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

Both gross motions of an entire core, as well as internal motion within the core relative to its supports, can be interpreted in a straightforward manner by applying the damped simple harmonic oscillator equation of motion. As a concrete example, the unclamped Palisades' barrel motion and resonant core internals can be understood in considerable quantitative detail through analysis of noise data from ex-vessel and in-core detectors,—and without knowing details of the hydraulic forcing functions. (auth)

15755 (COO-2461-1) NEW COMPUTATIONAL METHODS FOR THE SOLUTION OF MULTIDIMENSIONAL NEUTRON DIFFUSION PROBLEMS RELATED TO NUCLEAR REACTOR SAFETY ANALYSIS. Progress Report No. 1, June 1–October 15, 1974. Dorning, J. (Illinois Univ., Urbana (USA)). 1974. Contract AT(11-1)-2461. 7p. Dep. NTIS $4.00.

The generation of the matrix elements which appear in the partial current balance method (PCB) equations is being studied. For one-dimensional problems two methods of constructing these matrix elements, i.e. directly–from exact expressions, and approximately–via a variational principle, have been used. Both are very efficient. For two-dimensional problems directly generating the matrix elements from their series representations has been found to be satisfactory since the series have good convergence properties. Work is continuing on the generation of accurate approximate matrix elements via the variational principle for two-dimensional problems. Convergence, accuracy, and computing times for the PCB method have been studied for simple one-dimensional test problems and compared with those for the finite difference and finite element methods. The PCB method was superior in all of the cases studied. For given accuracy it was five to ten times as fast as the finite difference method and two to six times as fast as the finite element method. The two-dimensional PCB equations are being coded, and similar studies are beginning. Initial estimates indicate that the advantages of the PCB method over the other methods will be significantly greater in two-dimensional problems than it is in one-dimensional problems. The investigation of techniques for accommodating time-dependent changes of nuclear properties (feedback), and for combining the PCB method with special methods for the solution of stiff differential equations has begun. (auth)

15756 (COO-2461-2) APPROXIMATE GENERATION OF COUPLING PARAMETERS FOR MULTIDIMENSIONAL NEUTRON DIFFUSION CALCULATIONS. Burns, T. J.; Dorning, J. J. (Illinois Univ., Urbana (USA)). 1974. Contract AT(11-1)-2461. 6p. (CONF-741086-8). Dep. NTIS $4.00.

From American Nuclear Society national meeting; Washington, District of Columbia, USA (27 Oct 1974).

One of the primary difficulties encountered in the application of integral methods to multidimensional reactor calculations has been the generation of the required coupling parameters which connect the neutronic behavior of the various volume elements. A computationally efficient method, based upon a variational (or weighted residual) principle, for generating such coupling parameters has been developed. Criticality calculations for a simple [2 region, 2 group] HTGR model to determine the effect of the approximate generation of the "Green's elements" show that the approximate generation is extremely effective. Thus, sufficiently accurate matrix elements, double moments of the Green's functions, have been generated while the need to do the (often costly) explicit evaluation of the Green's functions has been avoided. (auth)

15757 (DPSTM-500(Vol. 1)) JOSHUA SYSTEM. Vol. 1. General. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Nov 1969. Contract AT(07-2)-1. 104p. Dep. NTIS $8.25.

The third generation of computers now in use at most nuclear reactor design installations offers new possibilities to the developers and users of reactor computing codes. At the Savannah River Laboratory, the JOSHUA system is being developed to capitalize on the experience gained with earlier systems and to include a remote terminal capability. JOSHUA is an operating system which provides the data handling services required to accomplish extensive, iterative scientific calculations on a large semi-permanent data base. JOSHUA provides standard, "catalogued procedures" for solving routine problems, and allows easy redefinition of these procedures for experimental computation. The user is permitted to intervene between steps of a computation, display results, and possibly redirect the procedure. The use of individual display terminals for problem setup and output display is central to the design philosophy of JOSHUA, although duplicate facilities are provided for batch mode use where practicable. (auth)

15758 (DPSTM-500(Vol. 2)) JOSHUA SYSTEM. Vol. 2. User's Guide. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Sep 1973. Contract AT(07-2)-1. 310p. Dep. NTIS $18.50.

Information pertaining to the design, programming, and use of JOSHUA modules, and the use of the JOSHUA Monitor System (JMS) is presented. The design concepts discussed should be helpful to analysts, programmers, and users of the system. Parts B and C are intended primarily for use by analysts and programmers, and presuppose a knowledge of both IBM 360 FORTRAN and OS/360 facilities. The monitor system is also described. (auth)

15759 (DPSTM-500(Vol. 2.1)) JOSHUA SYSTEM. Vol. 2.1. User's Guide. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Jan 1974. Contract AT(07-2)-1. 157p. Dep. NTIS $11.00.

Information is presented concerning the special application functions and system diagnostics. (DCC)

15760 (DPSTM-500(Vol. 3)) JOSHUA SYSTEM. Vol. 3. Data Set Specs. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Sep 1973. Contract AT(07-2)-1. 329p. Dep. NTIS $19.50.

Information is presented concerning guidelines for specifications of data sets, cross section data sets, lattice physics data sets, correlation data sets, reactor physics data sets, and engineering data sets. (DCC)

15761 (DPSTM-500(Vol. 5)) JOSHUA SYSTEM. Vol. 5. Basic Data Processing. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). May 1971. Contract AT(07-2)-1. 192p. Dep. NTIS $12.75.

Information is presented concerning neutronics data processing and engineering data processing. (DCC)

15762 (DPSTM-500(Vol. 9)) JOSHUA SYSTEM. Vol. 9. Operating System. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Oct 1973. Contract AT(07-2)-1. 414p. Dep. NTIS $23.75.

Information is presented concerning the precompiler, data management, and the JOSHUA monitor. (DCC)

15763 (DPSTM-500(Vol. 9.1)) JOSHUA SYSTEM. Vol. 9.1. Operating System. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Dec 1973. Contract AT(07-2)-1. 274p. Dep. NTIS $16.75.

Information is presented concerning system functions, modules, and subprograms. (DCC)

15764 (DPSTM-500(Vol. 9.2)) JOSHUA SYSTEM. Vol. 9.2. Operating System. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Jan 1974. Contract AT(07-2)-1. 286p. Dep. NTIS $17.50.

Information is presented on the JOSHUA system modules. (DCC)

15765 (DPSTM-500(Vol. 9.3)) JOSHUA SYSTEM. Vol. 9.3. Operating System. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Jun 1974. Contract AT(07-2)-1. 290p. Dep. NTIS $17.50.

Information is presented concerning JOSHUA system modules and subprograms. (DCC)

15766 (WANL-TME–1222) EXTENSION OF STRATTON'S CRITICAL DIMENSIONS FOR C–^{235}U–H_2O SYSTEMS. Scarano, R. A.; Vachon, L. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1965. 14p. Dep. NTIS $4.00.

Basic criticality parameters for Uranium (93.5)-Graphite-Water systems calculated by Stratton are limited to a maximum fuel loading of 500 mg/cc Uranium (C/U of 77.5). This parametric study has been extended herein to a fuel loading of 700 mg/cc Uranium (C/U of 54.76). The results, which are summarized, include values for unreflected and 8-inch water-reflected systems. Critical parameters are plotted as functions of the hydrogen-to-^{235}U atomic ratio. To facilitate evaluation of critical parameters on a volume fraction basis, the relationship between the H/^{235}U atomic ratio and the volume fraction of the system occupied by water is presented. Stratton data for two fuel loadings have been included for reference purposes. (auth)

15767 (WANL-TMI-567) NON-SEPARABLE KINETICS PROGRAM. Riese, J. W.; Laush, D. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Mar 1963. 12p. Dep. NTIS $4.00.

The amplitude, spatial distribution and changes with time of the neutron flux associated with an arbitrary number of flux energy groups and delayed neutron precursor groups are calculated using a semi-direct variational method. Only preliminary test calculations are given and the results compared with other methods of calculation. (LTN)

15768 (WANL-TNR-106) CONDITIONAL MONTE CARLO PROGRAM FOR SOLVING THE TRANSPORT EQUATION. Killinger, A. H.; Saalbach, C. P.; Drawbaugh, D. W. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 8 May 1963. 235p. Dep. NTIS $14.75.

Monte Carlo Methods of solving neutron transport problems are usually considered to have three advantages compared with finite difference methods. These are: More accurate representation of the physical reactions, more accurate representation of boundaries between regions of different composition and greater efficiency compared with finite difference methods as the dimensionality of the problem increases. At the same time Monte Carlo methods have a number of disadvantages viz. the nature of the solution being a statistical estimate rather than a deterministic solution, the inability to make full use of an approximate solution as input, the inability to obtain results at chosen points or, if this defect is removed by some technique, uncertainty over the possible introduction of an effective bias, the large amount of computer time usually required and, sometimes, inflexibility of a program limiting it to a small class of specialized problems. The Monte Carlo program described here has been designed to eliminate some of the above disadvantages. (auth)

15769 (ZJE-151) EXPERIMENTAL INVESTIGATION OF THE INFLUENCE OF STRAIGHT THROUGH-GOING CYLINDRICAL CHANNELS ON THE PROPERTIES OF IRON-GRAPHITE SHIELDING. Holman, M. (Skoda, Plzen (Czechoslovakia)). 1974. 20p. Dep. NTIS (US Sales Only) $4.00.

The results of experimental research in the BR-5 reactor on the impact of straight through cylindrical channels on shielding properties of laminated iron-graphite shielding against fast neutrons are presented. This extension of previous work presents the results in a form enabling a direct determination of the fast neutron flux density along the channel axis and its dependence on channel diameter and the area of isotropic source of neutrons. The method of measuring the influence of channel lattice (channel dia 200 mm, pitch 350 mm) on shielding properties is described, and the results obtained are given. (auth)

Reactor Components and Accessories

15770 (CONF-741065-9) FAST RESPONSE THERMOCOUPLE FOR TEMPERATURE FLUCTUATION MEASUREMENTS IN SODIUM COOLANTS. Bunschi, H.; Seifritz, W. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). 1974. 7p. Dep. NTIS (US Sales Only) $4.00.

From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

A special chromel/alumel thermocouple was fabricated whereby the bare ends of the wires were fixed about 1 mm apart. In a medium with a good electrical conductivity (e.g. liquid sodium) the junction of this thermocouple is replaced by the medium itself. Hence, a fast undelayed response is expected. Experimental data for this device compared with corresponding dynamical data for conventional thermocouples will be presented. The mean temperatures of both elements are in good agreement, and the open element exhibits a much faster time behavior than conventional thermocouples. (auth)

15771 (WANL-TME-1398) OPERATIONAL MANUAL FOR ETS-1 TSCS LOW VOLTAGE POWER SUPPLY CHASSIS. Brinda, J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 8 Mar 1966. 27p. Dep. NTIS $4.50.

The power supply furnishes I 16VDC for the WANL Reactor Safety System. It is a rack-mounted, all solid-state (positive and negative) power supply with redundant, auctioneered backup units. The unit modules are short-circuit protected and over-voltage protection to equipment using the supply is provided by external circuitry. The solid-state devices give reliable operation and have a long life. Other components are military standard or better and the whole unit involves good commercial practice. Specifications, operating instructions, maintenance instructions, acceptance test procedures, and functional test procedures are given. (LTN)

15772 NUCLEAR FLUID-HANDLING EQUIPMENT. O'Keefe, W. Power (N. Y.); 118: No. 5, s1-s24(May 1974).

Basic considerations of coolant fluid handling in BWR, PWR, HTGR, and PHWR reactor are reviewed. Design features and specifications are discussed for pumps, seals, motors, valves, and piping. Water treatment and control systems are also discussed. (DG)

15773 REACTOR IRRADIATION EQUIPMENT. Chamrad, B. Nukleon; No. 4, 3-6(Dec 1973). (In Czech).

The equipment is described for irradiation of fuel and structural materials, mainly of steel for the construction of reactor pressure vessels. The irradiation equipment consists of three main parts. The principal part, the irradiation cylinder, is mounted in the reactor core; the so-called centre of information and regulation (CIR) comprising electronic equipment is the second part. The communication system connecting the irradiation cylinder to CIR, thus providing the transmission of information, of control signals, or energy and mass, is the third part. (INIS)

15774 SENSOR OF AN ADIABATIC REACTOR CALORIMETER. Marik, P. Czech Patent 148331. 29 Jun 1972. 3p. (In Czech).

A sensing unit is proposed of an adiabatic reactor calorimeter consisting of an evacuated flask with thermocouples and a sensing element placed inside the flask. The sensing element is fixed using mica spacers inside the shielding jacket on which the heating coil is wound. The advantage of the sensor consists in the capability of measuring rapid changes in heat generation in dynamic conditions. The evacuated space and the heated shielding jacket ensure the adiabatic regime within a wide range of temperatures, limited only by the materials used in the manufacture of the sensor. (INIS)

Reactor Fuels

Refer also to abstracts 13817–13820, 13823, 13824, 14509, 14512, 14518, 14596, and 15808.

15775 (CONF-741065-30) HEAT TRANSFER TIME CONSTANT OF A FUEL PIN DETERMINED BY NOISE ANALYSIS. Robinson, E. (Institutt for Atomenergi, Halden (Norway). OECD Halden Reaktor Prosjekt). 1974. 10p. Dep. NTIS (US Sales Only) $4.00.

From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

The heat transfer time constant of a fuel pin, inserted in a light water reactor, is determined by cross-power spectral density measurements, utilizing power reactor noise. The phase of a measured transfer function between reactor power fluctuations and the signal of a center oxide thermocouple in a fuel pin is interpreted by a point model of the temperature dynamics of the fuel rod. The effect of the time constant of the thermocouple is also considered. The model is shown to be adequate in the analyzed frequency region. (auth)

Reactor Control Systems

15776 (GULF-GA-A-12503) HTGR GAS TURBINE POWER PLANT CONTROL, SAFETY, AND MAINTENANCE STUDIES. Semiannual Progress Report for the Period July 1, 1972 Through December 31, 1972. (Gulf General Atomic Co., San Diego, Calif. (USA)). 22 Feb 1973. Contract AT(04-3)-167. 206p. Dep. NTIS $13.50.

The results of control, safety, and maintenance studies for the high-temperature gas-cooled reactor (HTGR) gas turbine power plant are presented. Extensive steady-state and transient performance analyses are described, and the two computer programs used to perform these analyses are documented. The performance results are discussed in terms of control system selection and a specific control concept is recommended for further study. The safety aspects of the HTGR gas turbine plant were reviewed. Certain safety areas that require more extensive investigation are identified, and the influence of safety considerations on design alternatives is noted. In the maintenance area, radioactivity levels in the primary circuit due to fission products and neutron activation have been estimated. The effect of these activity levels on maintenance operations and on lubricating oil are discussed. The Phase I studies of the preliminary design program led to decisions on the major design features of the HTGR gas turbine power plant, and these decisions are also reported. (8 references) (auth)

15777 (WANL-EOM-001) CONTROL DRUM ACTUATOR CHECKER. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 Nov 1963. 51p. Dep. NTIS $5.75.

The Control Drum Actuator Checker verifies the performance of the hydraulic control drum actuators prior to their installation on the reactor. The checker also provides for local checkout of the actuators following their installation. The checker has provisions for performing pneumatic seal and hydraulic leak testing on individual actuator assemblies prior to their installation. It supplies hydraulic pressure, pneumatic pressure, and electrical inputs to checkout and calibrate the torque transducers, thermocouples, feed-back potentiometers, limit switches, and hydraulic motors of the actuators (and feed-back assemblies) before they are installed on the reactor. The Checker is effectively a closed loop servo-system used as test equipment to verify the reciprocal angular positioning of the actuator when mounted on a test stand (simulating similar mounting on a reactor of novel

design). It utilizes a specially designed hydraulic-pneumatic power unit to provide the angular motion normal to actuators used on the aforementioned reactor. The actuator's motion of 0° to 180° produced by this system is readout on a counter on the electronics console panel face. The variations in output are readily observed on a six channel recorder. Comparisons of the output with the input cranked into the system can then be made. (auth)

15778 (WANL-TME-541) PRELIMINARY WANL EVALUATION OF THE NUCLEAR INSTRUMENTATION FOR THE NRX-A CONTROL SYSTEM. Gilmour, G. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 28 Sep 1963. 7p. Dep. NTIS $4.00.

The nuclear instrumentation is adequate for NRX-A requirements with the exception that it does not have a restart capability during the period immediately following reactor shutdown. A restart capability will not be required until the NRX-A-4 reactor according to program planning. The nuclear instrumentation has been designed for flexibility in incorporating such a capability when the circuitry is developed. The system can be improved with respect to R-F noise sensitivity and incorporation of improved radiation resistant preamplifiers. (auth)

15779 (WANL-TME-1125) CORE EXIT PRESSURE CONTROL SYSTEM AND COUPLED PRESSURE TEMPERATURE CONTROL SYSTEM FOR NRX-A3. Josephson, J.; Merchant, C. C. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 17 Mar 1965. 54p. Dep. NTIS $5.75.

The NRX/EST and the XE Engine Control requires coupling of the temperature and pressure control loops. Experimental information to verify the understanding of the inherent coupling of the two loops within the reactor is necessary to confidently complete the NRX/EST controller designs. Analysis has been completed on a pressure control system which may be safely used on NRX-A3 to perform experiments which will provide the information required to verify the computer models and lend direction to the NRX/EST controller designs. The analysis includes an investigation of coupling the loops externally and shows that slaving temperature to pressure is a practical means of controlling NRX-A3. Because of the fundamental importance of these tests to the NRX/EST control system design, it is recommended that these control experiments be performed on NRX-A3. (auth)

15780 (WANL-TME-1137) PREDICTED TRANSIENT BEHAVIOR OF THE NRX-A3 REACTOR SYSTEM RESULTING FROM LIMITER MALFUNCTIONS. Gurski, P. S. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 26 Mar 1965. 51p. Dep. NTIS $5.75.

An analog computer study has been conducted with the objective of predicting the transient consequences of temperature and neutronic limiter failures during power operation of the NRX-A3 system. Both open circuit and short circuit failures were investigated on a three-console computer model of the NRX-A3 reactor system. The model included the Test Cell "A" feed system and the power, temperature, and flow controller simulations. Failures were investigated at various operating conditions, including both high and low power. It was determined that short circuit failure causes the most severe transient consequences. This failure cannot be considered to be credible, however, since three independent circuit malfunctions must occur for a short circuit failure to happen. The results of short circuit failures for each limiter are described. (auth)

15781 (WANL-TME-1157) NRX/EST CONTROLS AND FACILITIES FAILURE MODE ANALYSIS. Wagner, G. L.; McLane, F. E.; Gormley, O. P. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 15 May 1965. 146p. Dep. NTIS $10.50.

A systematic review of the NRX/EST configurations is pertinent to successful testing of the reactor. An attempt has been made to include some of the facilities aspects of these configurations. Some systems have not changed significantly between the NRX-A2 and NRX/EST. These systems, previously described in WANL-TME-940, are included in order to provide more complete coverage. Only preliminary work has been done in the area of detailed review of component failure modes and evaluation of the numerical probability of occurrence of the hypothesized events. The description and evaluation of the NRX/EST control system are presented and the facility systems are described, including the propellant, auxiliary gas, hydraulics, and other systems vital to the successful completion of the test. (auth)

15782 (WANL-TME-1395) OPERATIONAL MANUAL FOR LRE AND ATE CONSOLE PANELS. Kowalcheck, H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 4 Mar 1966. 94p. Dep. NTIS $7.75.

The instrumentation panels contain displays and controls associated with the neutronic parameters for the engine and test stand control systems, reactor safety system, engine temperature and reactor control drums parameters. The various panels are described in detail and installation, operation, maintenance and acceptance procedures given. (LTN)

15783 (WANL-TME-1460) OPERATIONAL MANUAL FOR THE XE-1 ACTUATOR AMPLIFIER ±24VDC POWER SUPPLIES. Bartholomew, R. R. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 31 Oct 1966. 32p. Dep. NTIS $4.75.

The 24VDC Actuator Amplifier Power supplies to be used with XE-1 Control Drum Actuator Subsystem are described with specifications, theory of operation, procedures, maintenance suggestions and test specifications. Redundant solid state power supplies, powered from different phases, are auctioneered to provide the necessary reliability of operation. (LTN)

15784 (WANL-TME-1523) XE-1 CONTROL DRUM SYSTEM FAILURE MODE ANALYSIS. Starek, R. M.; Ottenheimer, F.; Wandell, G. F. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 30 Dec 1966. 84p. Dep. NTIS $7.25.

A failure mode analysis of the XE-1 Control Drum System has been conducted. The actuator control amplifier, actuator drive gas supply system, actuator and the control drum assembly comprise the system. The report presents a detailed analysis of the system and conclusions regarding the likely failure modes. (auth)

15785 (WANL-TME-1537) SERVO-ANALYSIS AND DYNAMIC TESTING OF THE PROTOTYPE NERVA XE PNEUMATIC ACTUATOR-AMPLIFIER SUBSYSTEM. Josephson, J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Nov 1966. 122p. Dep. NTIS $9.25.

The servo-analysis and dynamic testing of the 7T-AG20-A01 prototype NERVA XE pneumatic actuator-amplifier subsystem are reported. In the linear analysis the subsystem transfer functions are derived and the method of lead stabilization of the subsystem loop is described. The role of the dynamic pressure feedback (DPF) in providing high gain at low frequencies is discussed. The effects of stiction-coulomb friction loads, flow saturation and velocity limiting on the subsystem response and stability have been investigated by means of an analog computer simulation. It has been determined that these nonlinearities must be included in order to obtain a sufficiently accurate prediction of the subsystem response. The suppression of flow saturation limit cycling by means of velocity limiting is described. The redesign of the actuator amplifier into a completely solid state device and the method of stabilizing the driver amplifier current feedback loop are presented. Typical frequency response and transient response data obtained in the actuator laboratory for various conditions have been included. They indicate that stable, predictable dynamic performance of the actuator and amplifier can be obtained at ambient conditions with helium by specifying the proper subsystem gain, lead stabilization, and velocity limit parameters. Further testing indicates that stable, predictable dynamic performance can be obtained over the environment range with hydrogen. However, an intermittent high frequency instability, which was believed to have been suppressed, is still observed at cryogenic temperatures with helium. Efforts are underway to obtain a complete understanding of this phenomenon and to eliminate it, since helium is still necessary for some phases of testing. Furthermore, the stability margins using hydrogen are not well defined, and must be established more precisely for both design and off-design conditions. (auth)

15786 (WANL-TME-1913) CONTROL VANE HEATING MEASUREMENTS. Final Report. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Sep 1970. 102p. Dep. NTIS $8.25.

Radiation measurements were made on a Cu ^{10}B R-1 type control vane, (at a 115° drum angle), located in the test sector of the low power critical mockup of the R-1 reactor, PAX-G2A. Dosimeters used consisted of Dy–Al foils and wires and ^{6}LiF, ^{7}LiF and CaF_2 TLDs. Results were compared with analytical calculations based on the (R,θ) EXTERMINATOR-2 neutron diffusion code. Effective rather than dilute vane absorption cross sections yielded good agreement with the experimental results. (auth)

15787 (WANL-TME-1921) PROPORTIONAL ELECTRIC ACTUATOR. Development Test Report. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Apr 1969. 21p. Dep. NTIS $4.25.

The testing of a candidate proportional electric actuator Responsyn stepping motor, Model HDUM-30-100-04, is described.

The information is needed to verify analytical design parameters and to optimize the performance of control drum and structural support coolant valve actuators in the NERVA reactor. (LTN)

15788 (WANL-TME-1928) TWO POSITION ELECTRIC CONTROL DRUM ACTUATOR. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). May 1969. 30p. Dep. NTIS $4.50.

The testing of a two-position electric control drum actuator candidate, Responsyn stepping motor, Model HDUM-30-100-04, is described. A step input signal is used to obtain the two-position output of the actuator instead of a proportional input signal. The purpose is to obtain performance data on the two-position electric control drum actuator candidate to verify analytical design parameters and optimize the parameters to obtain the best overall subsystem performance. The results are required for control system design and analysis and are to be used as a partial input to actuator trade studies. The use of the stepping motor system appears feasible, however, the response time of the unit tested may be slower than desired. This could be improved by increasing the pulse rate of the pulse source or using a step-up gear train between the motor shaft and output shaft. Either of these methods would result in a decrease in the maximum output torque. In other words, a trade-off is required between speed of response and the output torque. (auth)

15789 FOURTEENTH JOINT AUTOMATIC CONTROL CONFERENCE OF THE AMERICAN AUTOMATIC CONTROL COUNCIL, COLUMBUS, OHIO, JUNE 20–22, 1973. New York; Institute of Electrical and Electronics Engineers, Inc. (1973). 982p. (CONF-730624–).

An abstract is prepared for the one paper included in NSA from the conference on automatic control systems. The paper included in NSA discussed the use of fluid control devices on space propulsion reactors. (DCC)

For an abstract of an individual paper see: 15790.

15790 FLUIDIC PROGRAMMER FOR NUCLEAR ENGINE APPLICATION. Felsing, G. W. (Aerojet Nuclear Systems Co., Sacramento, CA). pp 528-534 of Fourteenth Joint Automatic Control Conference of the American Automatic Control Council. New York; Inst. of Electrical and Electronics Engineers, Inc. (1973).

From joint automatic control conference; Columbus, Ohio, USA (20 Jun 1973). See CONF-730624-.

A program to demonstrate a nuclear rocket engine fluidic programmer concept has been completed. A selected portion of the programmer that produces chamber-temperature and pressure-demand profiles from the analog integration of logically controlled input steps was designed. The circuit components, several of them unique, were evaluated, successfully employed in breadboard models and later integrated into a single, improved-performance unit. The investigation indicates that a fluidic programmer is feasible. 6 references. (auth)

Nuclear Power Plant Economics

15791 (PEL-237E) BRIEF EXAMINATION OF THE STATUS OF NUCLEAR POWER IN THE REPUBLIC, USING 1974 COSTS. (Atomic Energy Board, Pelindaba, Pretoria (South Africa)). Aug 1974. 17p. (ISBN-0869605186). Dep. NTIS (US Sales Only) $4.00.

The introduction of nuclear power to the South African grid in the form of a Light-Water Reactor (LWR) appears to result in lower system-averaged costs to the end of the century. An installed nuclear capacity of 12,250 MWe is predicted by the year 2000. The economic date for reliable full-power operation for the first plant is computed to be 1983, with the second following a year later and a third in 1987, all at the same load centre. Predictions of the installed nuclear capacity prove to be extremely sensitive to future fuel costs, but insensitive to future interest rates. The emphasis would therefore appear to be on middle-term planning for the foreseeable future. Nuclear power appears competitive in Natal only if the price of coal escalates at a rate of 4 per cent per annum and nuclear fuel costs rem in as predicted. The introduction of nuclear power could result in a significant saving in the amount of coal used for power generation at the expense of only a 1 per cent depletion of our low-cost uranium reserves. (auth)

15792 ENERGY NOTES SEPTEMBER 1974: NUCLEAR ENERGY. Atoomenergie Haar Toepass.; 16: No. 11, 247-258 (Nov 1974). (In Dutch).

The article opens with an overall review summary of the international nuclear energy scene: historical development, present position and future trends. A detailed account is given of nuclear energy in the Netherlands, where by 1985 some 25% of the total generated electricity is expected to come from nuclear stations (compared with the present figure of ~ 4%). In conclusion a brief account is given of the Dutch-British-W. German ultracentrifuge project, which should be an important source of enriched uranium for future fast breeder reactors. (auth)

15793 NUCLEAR POWER CONSTRUCTION CUTBACKS AND THE ELECTRIC UTILITY INDUSTRY. Perl, L. J. Prof. Eng.; 44: No. 12, 18-22(Dec 1974).

Surveys indicate that some 27.3 percent of the total megawatt capacity additions of electric power scheduled to come on line in 1974 through 1983 had been cancelled or delayed by October, 1974. For the nuclear part of the power industry, cancellations and delays by the same month totaled approximately 46.2 percent. Such statistics have highly significant implications for both the construction industry and the continued expansion of U. S. electric energy production. (auth)

15794 TOWARDS SELF-RELIANCE IN NUCLEAR POWER. Srinivasan, M. R. (Department of Atomic Energy, Bombay (India). Power Projects Engineering Div.). Nucl. India; 12: No. 5, 18-22(Jan 1974).

The basic philosophy of the Indian nuclear power program is outlined. A slow transition is effected from availing of foreign and technical aid in the construction of the first atomic power station at Tarapur to partial aid in the construction of the second power station in Rajasthan and to complete indigenization in men and materials in the construction of the third power station at Kalpakkam (MAPP). A number of design modifications effected in the construction of the Madras Atomic Power Station to suit the location and climate are mentioned. Mention is also made of the fourth atomic power station planned to be constructed at Narora. It is pointed out that as the equipment supply determines the schedule, efforts should be directed towards developing more and more expertise in the fabrication of nuclear components. (INIS)

15795 PROSPECTS OF NUCLEAR POWER IN SUPPLYING OUR ENERGY REQUIREMENTS. Medina, F. A. (National Science Development Board, Rizal (Philippines)). Sci. Rev. (Manila); 15: No. 1, 3-11(Jan 1974).

The prospects of nuclear power in meeting the energy requirements of the Philippines are discussed. In 1972, the maximum demand for power was 1.36 million kW and in 1973 about 1.36 million kW. A 10% increase is calculated per year and by 1983, the maximum demand predicted will be 3.8 million kW. Ninety-seven percent of the energy source depends on imported fuel oil and 3% from hydroelectric and coal. Economic and feasibility studies undertaken by the IAEA with the financial backing of UNDP, first in 1964-66, then in 1973 favored putting up a nuclear power plant in Luzon. In point of cost, the nuclear power plant involves 2.4 times the investment of an equivalent oil-fired plant; its generation cost, however, is definitely lower. Another advantage is the availability of large amounts of energy within an electric network. Another is nuclear fuel availability. Uranium is found in Spain, India, U. S., Russia, and South America. There are also strong indications of the presence of uranium in the country. As to manpower for the nuclear power program, a great number of personnel in the Philippine Atomic Energy Commission have been trained abroad in the various aspects of nuclear energy. (INIS)

Reactor Fuel Cycle Economics

15796 (RT/EC-(74)1) FUTURE PROSPECTS IN ITALY OF THE NUCLEAR FUEL SERVICES INDUSTRY. Ambrosini, G.; Cicognani, G.; Comellini, O.; Zironi, I.; Valant, P.; Venditti, P. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Sep 1974. 113p. (CONF-731160-1). Dep. NTIS (US Sales Only) $8.75.

From meeting of the working group for the study of nuclear reactor strategies; Vienna, Austria (5 Nov 1973).

On the basis of ENEL's forecasts regarding the development of nuclear power in Italy until 1990, with extrapolations up to 2010, the evolution of the domestic market for the main nuclear reactor fuel cycle services is evaluated. In connection with similar estimates concerning the Western European market, and taking into account certain cost functions for the above mentioned services, a series of considerations on the development of Italian industry in the nuclear fuel cycle field is presented. (auth)

Reactor Licensing and Regulation

15797 (CENPD-132(Suppl.)) CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT 1. Supplement to Section IV.D.1 of CENPD-132, Containing the Modifications Required by the Sup-

plemental Staff Safety Evaluation Report. (Baltimore Gas and Electric Co., Md. (USA)). 6 Dec 1974.

15798 (DOCKET-50295-407) ZION NUCLEAR PLANT, UNITS 1 AND 2. Operating Report, June 1973–October 1974. (Commonwealth Edison Co., Chicago, Ill. (USA)). 1974. 43p. (DOCKET-50304-302). Dep. NTIS $5.25.

Brief summaries of the nuclear and electrical data from initial criticality to October 30, 1974 are presented. Unit 1 achieved initial criticality on June 19, 1973 and Unit 2 on December 24, 1973. Key parameters are summarized on a monthly basis and histograms of power versus time are included. (FS)

15799 (PRDI-74-12) TITLE LISTING OF POWER REACTOR DOCKET INFORMATION. Annual Cumulation. (USAEC Technical Information Center, Oak Ridge, Tenn.). Dec 1974. 845p. TIC $8.80.

Citations and subject indexing to the documentation associated with civilian nuclear power plants are presented. This material is that which is submitted to the Atomic Energy Commission in support of applications for construction and operating licenses. Citations are listed by Docket number in accession number sequence. The Table of Contents is arranged both by Docket number and by nuclear power plant name. (DCC)

GENERAL AND MISCELLANEOUS

Energy Utilization and Economics

15800 BATTERIES. Volume 1. Manganese Dioxide. Kordesch, K. V. (ed.). New York; Marcel Dekker, Inc. (1974). 577p. $47.50.

Chapters in this book present information on the following subjects: Leclanché flashlight batteries, primary and rechargeable alkaline manganese dioxide–zinc cells, electrochemistry of manganese dioxide and production and properties of electrolytic manganese dioxide, and magnesium (MnO_2–Mg) batteries. (268 figures, 89 tables, 503 references) (RWR)

Law

Refer also to abstract 14351.

15801 RECENT ASPECTS OF RADIOPROTECTION REGULATIONS. Chanteur, J. (Service Central de Protection contre les Rayonnements Ionisants, Le Vesinet, France). pp 19-28 of Radioprotection Regulations. Montrouge, France; Societe Francaise de Radioprotection (1973). (In French)

From meeting on radioprotection regulations; Paris, France (18 Jun 1973).

Present trends of radioprotection regulation and organization in France can be summed up under the headings of clearer separation of responsibilities and prerogatives, more realistic estimation of facts and risks, and stricter command of heavy equipment in all fields. In practice this tendency is expressed by a number of texts, which are analyzed in terms of the different fields of application: specifically nuclear, medical, neither nuclear nor medical (irradiation of foodstuffs, radiosterilization, radioactive wastes other than those of basic nuclear plants) and finally accidental situations. (FR)

15802 RADIOPROTECTION REGULATIONS AND THE E.D.F. Hebert, J. (Electricite de France, Paris). pp 29-36 of Radioprotection Regulations. Montrouge, France; Societe Francaise de Radioprotection (1973). (In French)

From meeting on radioprotection regulations; Paris, France (18 Jun 1973).

Recommendations of the IRPC and the ensuing norms of international organizations were used to establish national rules of application, especially with regard to the protection of members of the public against the effects of ionizing radiations emitted in Basic Nuclear Plants. In a first stage, in accordance with very general provisions such as those of the Decree of June 20th 1966, the population was protected by the insertion of regulations and the initiation of inspections, chiefly in the context of BNP building permits. The present trend seems to be towards a clearer separation of radioprotection and nuclear safety laws since the rules covering radioactive wastes should proceed in future from permits distinct from the Basic Nuclear Plant building permit. At the same time instead of merely stipulating that limits fixed by the basic Euratom norms should be respected, French regulations seem to be tending towards the definition of methods to evaluate the effects of waste discharge on the population so that these limits can be guaranteed before the permit is granted. (FR)

15803 ROLE OF THE NUCLEAR ENERGY AGENCY OF THE OECD IN THE MATTER OF RADIOPROTECTION LEGISLATION. Strohl, P. (Nuclear Energy Agency, Paris). pp 59-64 of Radioprotection Regulations. Montrouge, France; Societe Francaise de Radioprotection (1973). (In French)

From meeting on radioprotection regulations; Paris, France (18 Jun 1973).

One of the duties of the Nuclear Energy Agency is to harmonize health protection legislation, an activity which is conducted through recommendations to governments. These recommendations take different forms, more or less restrictive: norms, guides or simple codes of procedure. The results obtained and future lines of action are analyzed. The work accomplished concerns fundamental radiological protection norms based on IRPC recommendations on the one hand, applied norms or codes of procedure on the other. The applied norms adopted within the OECD concern standard equipment for which both safety and international trade factors are of prime importance. The different existing norms are listed, and among those in preparation the special case of heart stimulators is quoted. The activities of the NEA regarding radioactive waste discharge into the sea are mentioned. One of the new lines of work emphasized is the comparative evaluation of the dangers and advantages which nuclear applications present for man and his environment. (FR)

15804 RADIOPROTECTION REGULATIONS AT THE COMMISSARIAT A L'ENERGIE ATOMIQUE. de Nercy, B. (CEA, Paris). pp 37-47 of Radioprotection Regulations. Montrouge, France; Societe Francaise de Radioprotection (1973). (In French)

From meeting on radioprotection regulations; Paris, France (18 Jun 1973).

The practical problems of personnel protection in CEA Centres are discussed, with special reference to the difficulties encountered in the application of the texts. It is recalled in particular that the decree of March 15th, 1967 applies to small establishments and not to basic nuclear plants. In spite of the statute of April 24th, 1968, granting certain concessions to the CEA, a number of problems remain. In order that the legislation drawn up from these texts may be applied uniformly in all centers the CEA has issued instructions to the authorities concerned. These instructions bear chiefly on three points: declarations and administrative formalities to be accomplished, especially towards the work inspection services, division of centers into working zones and personnel into categories, this point being very important, and finally problems of supervision and dosimetry. Attention is drawn to the fact however that a decree relative to personnel protection in large nuclear plants is needed urgently. (FR)

15805 HEALTH ASPECTS OF THE POPULATION FROM RADIATIONS AROUND THE NUCLEAR PLANTS. Amaldi, U.; Campos Venuti, G. Ann. Ist. Super. Sanita; 9: No. 4, 199-217 (1973). (In Italian).

The legislative bases for the work of the technical commission of the CNEN in health physics are briefly outlined. The principal problems connected with the health protection around a nuclear installation are discussed from the viewpoint of the selection of the reference incident, reference doses for the evaluation of serious nuclear incidents, and the siting of nuclear plants. Some unresolved problems of the present nuclear legislation are briefly indicated. (JSR)

Management

15806 (WASH-1293(Rev.1)) GUIDE AND CHECKLIST FOR THE DEVELOPMENT AND EVALUATION OF STATE AND LOCAL GOVERNMENT RADIOLOGICAL EMERGENCY RESPONSE PLANS IN SUPPORT OF FIXED NUCLEAR FACILITIES. (USAEC Office of Regulation, Washington, D. C.). 1 Dec 1974. 74p. Dep. NTIS $4.75.

This document provides radiological emergency response planning guidance to state and local governments for occurrences that might have impact on public health and safety arising from the operation of any type of fixed nuclear facility. Although primarily targeted to the increasing number of licensed nuclear power plants, the planning elements enumerated in this guide can also be applied to reactor fuel reprocessing plants, test and research reactors, and other facilities using or producing large quantities of radioactive material. The degree to which the elements should be applied to facilities other than power plants is a matter of judgment which should take into consideration the relative potential for serious accidents at these facilities. A checklist of major planning elements is provided to assist both experienced and inexperienced planners in constructing a comprehensive radiological emergency response plan. Each section of the checklist is backed up by specific guidance language. Completion of the checklist will not in itself constitute a Radiological Emergency Response Plan, but will aid in identifying deficiencies in current plans. Although many of the planning elements are also applicable to transportation accidents involving radioactive materials, such accidents have several unique characteristics which warrant separate guidance. They have therefore generally been omitted from the coverage of this guide. (CH)

15807 ACTIVITIES OF THE CMEA AGENCIES IN THE FIELD OF ENVIRONMENTAL PROTECTION AND IMPROVEMENT IN CONNECTION WITH RADIATION SAFETY PROBLEMS. Hake, W. (Council for Mutual Economic Assistance, Moscow). pp 131-136 of Environmental Surveillance Around Nuclear Installations. Vol. I. Vienna; International Atomic Energy Agency (1974). (In Russian).

From symposium on environmental surveillance around nuclear installation; Warsaw, Poland (5 Nov 1973). See STI/PUB-353 (Vol.1); CONF-731117-(P1).

In the recent years cooperation among the Council for Mutual Economic Assistance, Moscow (CMEA) member countries in the field of environmental protection and improvement in the context of ensuring radiation safety has been steadily expanding. This

paper comprises decisions of corresponding CMEA members in carrying out their extensive work in the above field, information on the setting up of the Scientific and Technological Coordination Council on Radiation Safety, and a summary of the CMEA scientific and technological cooperation program aimed at securing radiation safety. (auth)

15808 COMPOSITE FUEL ELEMENTS FROM URANIUM. Hugo, J. P. B. (Atomic Energy Board, Pelindaba, Pretoria (South Africa)). Coal, Gold Base Miner. S. Afr.; 11-15(Dec 1972).

South Africa's uranium production capacity will probably far exceed the local demand for fuel for power generation purposes. South Africa is exporting its uranium in increasingly refined and processed forms and may ultimately export in composite fuel elements. The exploitation of other minerals in nuclear applications and the rapid escalation of nuclear power costs are also discussed. (INIS)

Mathematics and Computers

15809 (AERE-R-7900) DESIGN OF SOFTWARE FOR A PDP-11-CAMAC CONFIGURATION. Winsborrow, R. P. J. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Nov 1974. 18p. Dep. NTIS (US Sales Only) $4.00.

The design of software which enables the facilities of a multicrate CAMAC system to be utilized by a PDP-11 is described. The hardware interface between the CAMAC system and the PDP-11 is the D.E.C. CA-11A branch driver. The softward described allows the CAMAC hardware to be handled in a manner compatible with the DEC-supplied single user operating system for the PDP-11 (DOS). Using the software and hardware described, a Tektronix 611 storage tube and a special purpose alphanumeric keyboard have been interfaced to a PDP-11/20 to provide an alphanumeric visual display unit. This unit can be used as a normal DOS terminal for alphanumeric I/O. It has been successfully used in conjunction with system programs provided by DEC for the PDP-11. (auth)

15810 (ANCR-1184-4) RAMOS FOCAL PROGRAMMING MANUAL. Myers, W. R.; Davies, R. C. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). Nov 1974. Contract AT(10-1)-1375. 33p. Dep. NTIS $4.00.

RAMOS FOCAL is a version of the Digital Equipment Corporation FOCAL (Formulating On-Line Calculations in Algebraic Language) high level interpretive language processor. It has been modified to operate with the RAMOS PDP-15 operating system, and optimized for the PDP-15 instruction set. Several features have been added, including program library operations, program chaining, computed "GOTO", more versatile output formatting, and program selection of input and output devices. (auth)

15811 (ANL-8137) KAPPA LEVEL OF SPEAKEASY. Cohen, S.; Pieper, S. C.; Stob, M. (Argonne National Lab., Ill. (USA)). Nov 1974. Contract W-31-109-eng-38. 142p. Dep. NTIS $5.45.

The capabilities of the Speakeasy processor have been greatly enhanced with the release of a new processor, referred to as the Kappa level, being distributed to all active Speakeasy sites and should replace all older versions. The enhancements are described. Information necessary to allow exchange of information between Speakeasy and standard Fortran programs is also provided. There has been a considerable increase in the vocabulary of words available to users. A complete listing of the new HELP documents is provided. (auth)

15812 (BNL-18889) COMPUTER AIDED DESIGN OF PROCESSOR ARCHITECTURES. Peskin, A. M. (Brookhaven National Lab., Upton, N. Y. (USA)). 16 May 1974. 16p. (CONF-750107-1). Dep. NTIS $4.00.

From Association of Computing Machinery Symposium; Houston, Texas, USA (21 Jan 1975).

A design automation system is described that has certain features that make it particularly well suited to the automation and analysis of entire digital systems; including hardware, firmware, and software. The code includes features for automated synthesis, simulation, and documentation. The languages, called LINDA and MODEL, and their processing algorithms are described. Examples of computer architecture studies that were conducted using LINDA and MODEL are also presented. These include development of an associative processor and investigations related to a logic-in-memory architecture. It is stressed that reliance on the appropriate design automation procedures has expedited the work and reduced the cost of research by eliminating the implementation phase as a necessary prerequisite to the study of machine concepts. (auth)

15813 (BNWL-SA-5078) MEMORY DATA STORAGE VIA DECTAPE. Kosorok, J. R.; Ratcliffe, C. A. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). [nd]. Contract AT(45-1)-1830. 7p. (CONF-741107-2). Dep. NTIS $4.00.

From DECUS symposium; San Diego, California, USA (5 Nov 1974).

A digital logic system and computer software to use DECtape transports as data transfer devices for pulse-height analyzer memories were developed. Battelle has a mini-computer controlled system that transfers data between fifteen analyzer memories and DECtapes and other systems that transfer directly from one or two memories to transports. The Battelle developed analyzer interface consists of three elements: the Omnibus interface card, the analyzer I/O controller, and the isolator and logic shifter. (MCW)

15814 (IFVE-SPK-73-94) PROGRAM FOR CALIBRATION OF MEASURING INSTRUMENTS WITH ORTHOGONAL COORDINATE SYSTEM. Gorichev, P. A.; Zakamskii, L. L. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 15p. (In Russian). INIS.

A program operating on a LCL 1903A computer is described for calibrating measuring devices having an orthogonal system of coordinates. The program finds optimal linear operators for converting the measured coordinates to an ideal system, and then calculates the variance vectors for a given set of points—the correction map. (tr-SJR)

15815 (JINR-11-7241) PACKET PROCESSING IN THE COMPUTER SOFTWARE "DUBNA" SYSTEM OF THE BESM-6 COMPUTER. Zaikin, N. S.; Semashko, G. L.; Shirikov, V. P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1973. 8p. (In Russian). INIS.

A description is given of a number of new capabilities in the "Dubna" software of the BESM-6 computer which consists of the dispatcher D-71 and the monitoring system "Dubna". By means of these capabilities it is possible to bring about a change in the execution of the inlet packets of problems on the inlet tapes, to organize an automatic accounting of the problems that have been accumulated, and to distribute the results both to real units, and also to outlet tapes with subsequent unloading to the real units. (tr-SJR)

15816 (JINR-P13-8271) CONTROLLER INTERFACING THE CAMAC SYSTEM WITH THE COMPUTER M-6000. I. Logic of Operation and Functional Possibilities of the Controller M-6000. Bespalova, T. V.; Golutvin, I. A.; Kondrashov, V. D.; Smolin, D. A. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1974. 25p. (In Russian). Dep. NTIS (Us Sales Only) $4.25.

The operation logic of the device interfacing the CAMAC system with the computer M-6000 is described. This device provides the possibility of performing all the operations according to the CAMAC rules and allows the information exchange between the CAMAC system and the computer under the regimes of programmed data transfers and the block transfers using the programmed channel or direct memory access (DMA) channel of computer. (auth)

15817 (LA-5816-MS) DETERMINATION OF ELLIPSES SATISFYING VARIOUS POINT-SLOPE CONDITIONS. Everett, C. J.; Taylor, W. M. (Los Alamos Scientific Lab., N. Mex. (USA)). Dec 1974. Contract W-7405-eng-36. 11p. Dep. NTIS $4.00.

It is of interest in connection with problems of design to be able to determine the ellipse $\alpha^2(x - x_0)^2 + \beta^2(y - y_0)^2 = 1$ passing through a given set of points, with certain slope conditions. For the "2 point, 2 slope" and "3 point, 1 slope" cases, necessary and sufficient conditions are given for the existence of such an ellipse, and its parameters x_0, y_0, α^2, β^2 are obtained as rational functions of the prescribed coordinates and slopes. Numerical examples are included. (auth)

15818 (LBL-3392) INTRODUCTION TO LLCAD (LAWRENCE LABORATORY COMPUTER AIDED DESIGN). Katz, J. E.; Jacobsen, V. L. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Oct 1974. Contract W-7405-eng-48. 7p. (CONF-741001-37). Dep. NTIS $4.00.

From CUBE symposium; Livermore, California, USA (23 Oct 1974).

LLCAD is a mostly FORTRAN computer program designed to relieve the user of the tedious jobs associated with the design, production, documentation, and maintenance of digital systems. LLCAD is written to operate on the CDC 7600 computer systems at LLL and the over-all structure and operation of the program are described. The input processor and report generator portions of the code are described, and a general description of the LLCAD language and an example of its use is provided. (auth)

15819 (PTB-FMRB-54) PROCEEDINGS OF THE FIFTH ANNUAL CONFERENCE ON THE USERS' ORGANIZATION I SIEMENS PROCESS COMPUTERS (SAK I), BRUNSWICK, WEST GERMANY, April 2–4, 1974. Weise, K. (ed.). (Physikalisch-Technische Bundesanstalt, Braunschweig (F. R. Germany). Forschungs- und Messreaktor). Sep 1974. 249p. (In German). (CONF-740481-). Dep. NTIS (US Sales Only) $15.50.

The meeting was held for the exchange of information and experience among the users of Siemens process computers, for presentations of results of interesting private works, and for discussions with Siemens personnel on actual problems and new developments in the field of hardware and software. Participants were 135 users and members of research and training institutes and of businesses. Twenty-two papers are summarized. (MCW)

15820 (RT/EL-(74)5) MINIMIZATION OF A COMBINED LOGIC CIRCUIT BY THE USE OF THE "EXCLUSIVE OR". Serra, A. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Apr 1974. 13p. (In Italian). Dep. NTIS $4.00.

A method is described that allows evidence of the EXCLUSIVE-OR of a Boolean function. The related logic network may be accomplished by means of AND, OR, and EXCLUSIVE-OR integrated circuits. A reduction in number of inputs and integrated circuits is often achieved by this procedure. (tr-auth)

15821 (SLAC-175) MAC74, A GENERAL PURPOSE MACRO PROCESSOR. Park, J. C. H. (Stanford Linear Accelerator Center, Calif. (USA)). Sep 1974. Contract AT(04-3)-515. 72p. Dep. NTIS $5.45.

A general purpose macro processor is described that is easy to use, has many versatile features, and is designed to be macro-processed for easy modifications and extensions. Part I shows how the processor is used for various purposes in actual examples of programming. Part II is a user's guide and reference containing a detailed description of the processor in this aspect. (auth)

15822 (UCCND-CSD-7) NUMERICAL SOLUTION TO THE GENERALIZED EIGENVALUE PROBLEM. Ward, R. C. (Union Carbide Corp., Oak Ridge, Tenn. (USA). Nuclear Div.). Dec 1974. Contract W-7405-eng-26. 67p. Dep. NTIS $5.45.

Most of the popular algorithms for numerically solving the generalized eigenvalue problem are briefly analyzed with special emphasis placed on the QZ algorithm and the combination shift QZ algorithm. The emergence of infinite eigenvalues under exact arithmetic is discussed in detail for both these algorithms. This leads to the presentation of an improved version of the combination shift QZ algorithm. The reduction of eigenvalue problems involving higher powers of λ to a generalized eigenvalue problem is also discussed. (auth)

15823 (UCCND-CSD-8) TABLES OF MOMENTS OF THE SKEWNESS AND KURTOSIS STATISTICS IN NON-NORMAL SAMPLING. Bowman, K. O.; Shenton, L. R. (Union Carbide Corp., Oak Ridge, Tenn. (USA). Nuclear Div.). Jan 1975. Contract W-7405-eng-26. 127p. Dep. NTIS $5.45.

Test statistics for the null hypothesis of normality, such as skewness ($\sqrt{b_1}$), kurtosos (b_2), range/(standard deviation), were developed early in the present century, mainly from an analytical viewpoint. The distributions of the first two to the extent of selected percentiles are now known to have sufficient accuracy for most applications. The power of these and related test statistics has been fairly extensively studied by Monte Carlo simulations in recent years. It seems fair to say that one or other of the directional test statistics $\sqrt{b_1}$ and b_2 under a number of popular alternate hypotheses (such as χ^2 with one or two degrees of freedom, Laplace with one parameter, log-normal, Cauchy, Poisson, Binomial) rival any other test statistics for power, the nearest rival being the Shapiro-Wilk W test, which cannot separate skewness and kurtosis characteristics. The present tables give the n^{-1} through n^{-6} coefficients in the first eight moments of $\sqrt{b_1}$ and the first six moments of b_2 for sets of alternates whose moments exist. In addition, approximate minimum sample sizes are indicated for "safe" usage of the asymptotic moment series. The sets of alternates include (a) Pearson Type 1, (b) mixture of two normals (common variances), and (c) Charlier Type A normal. Applications include four or more equimomental approximations to the distribution of $\sqrt{b_1}$, b_2 from, for example, the uniform and a wide class of other standard distributions for moderate to large sample sizes for which Monte Carlo work would become intolerably time consuming and expensive. (auth)

15824 (UCID-3001(Rev.3)) GEAR: ORDINARY DIFFERENTIAL EQUATION SYSTEM SOLVER. Hindmarsh, A. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Dec 1974. Contract W-7405-Eng-48. 72p. Dep. NTIS $6.75.

GEAR is a package of subroutines for the numerical solution of systems of ordinary differential equations, given the initial values. It is particularly well suited for stiff systems but can be used generally. The package contains both the implicit Adams methods and the backward differentiation formulas, or the methods of C. W. Gear, as options, and is based on a program written by Gear. (auth)

15825 (UCRL-76016) ANALYTIC TOOLS FOR THE EXAMINATION OF SECURITY ASPECTS OF OPERATING SYSTEMS. Webb, D. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Sep 1974. 14p. Dep. NTIS $4.00.

The security of commercial operating systems is studied. The project is concerned strictly with software aspects of security and is actively examining the vulnerability of several operating systems. A methodology was established and tools developed to aid in the test and evaluation (T&E) of the systems. A tool is defined as any program or set of programs that aids in automating the security T&E of an operating system. Effectively, this implies any program that helps an analyst locate security flaws or coding errors that could lead to a system penetration. Because there is a wide range of potential flaws and errors as well as considerable variance in their complexity, a number of different tools were developed. These tools fall into three classes: analytic, testing, and modeling. Research performed on the development and use of analytic tools is described. In the next section, background information is covered. This includes a discussion of the underlying motivation, different types of tools, and properties of the analytic tools. Section Three covers the overall structure of the tool operation and how analysts apply the tools. A description of specific tools and current results is covered in Section Four. The final section presents plans for future tool development. (MCW)

15826 (WANL-TME-2776) BILL OF MATERIAL PROCESSOR FOR THE IBM 360 COMPUTER. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Feb 1971. 94p. Dep. NTIS $7.75.

A Bill of Material Processor that is written for the IBM 360 Computer is described. The program provides for the maintenance and updating of a random access file that contains engineering information on parts. Any or all parts may, upon request, be exploded into their component parts. Such explosions also produce a total list of requirements for all component parts. (auth)

Miscellaneous

15827 (BNWL-SA-5061(Rev.)) DRY DEPOSITION AND RESUSPENSION OF AEROSOL PARTICLES: A NEW LOOK AT SOME OLD PROBLEMS. Slinn, W. G. N. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. Contract AT(45-1)-1830. 59p. (CONF-740921-21). Dep. NTIS $6.00.

From atmosphere–surface exchange of particulate and gaseous pollutants symposium; Richland, Washington, USA (4 Sep 1974).

Some problem areas in the study of dry deposition and resuspension of aerosol particles are viewed from a different perspective. First some inferences are made about possible aerosol particle log-area distributions that could be found in the atmosphere and qualitatively about the roles of dry deposition and resuspension. The dry deposition process in each of five layers A through E (Aloft, Boundary, Canopy, Deposition, and Edaphic Layers) is considered separately and it appears that the overall process could be rate limited in any one (or more) of these layers. Two simple models for dry deposition to a smooth surface and to a canopy are presented. For the resuspension problem suggestions are made that a kinetic equation for the soil particle size distribution should be explored further, that the critical u_* required to move small particles may have an aerodynamic interpretation, that the soil particle size distribution dictates the saltation flux particle size distribution except for very large (~1 mm) particles, and that the convective diffusion equation is incapable of describing the suspended particle size distribution. A simple model is proposed for simultaneous deposition with some resuspension. The paper closes with an attempt to explain the physically meaningful variability of the resuspension factor. (auth)

15828 (BNWL-SA-5080) WASHOUT COEFFICIENTS FOR POLYDISPERSE AEROSOLS. Dana, M. T.; Hales, J. M. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. Contract AT(45-1)-1830. 20p. (CONF-741003-8). Dep. NTIS $4.00.

From precipitation scavenging conference; Champaign, Illinois, USA (13 Oct 1974).

Washout properties of irreversibly scavenged atmospheric pollutants are necessary for environmental impact analyses. An attempt was made to interpret the gap between theoretical expectations and experimentally measured washout properties of polydisperse aerosols. It is concluded that washout coefficients of any

order for the aerosols depend upon the characteristics of the particle size spectrum as well as the raindrop spectrum and the collection efficiencies. The collection efficiencies were assumed to be of a certain mathematical form in the analysis. (MCW)

15829 (BNWL-SA-5084) PRECIPITATION SCAVENGING IN A SQUALL LINE: NUMERICAL EXPERIMENTATION. Hane, C. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. Contract AT(45-1)-1830. 12p. (CONF-741003-9). Dep. NTIS $4.00.

From precipitation scavenging conference; Champaign, Illinois, USA (13 Oct 1974).

A numerical model of squall line convection was utilized to obtain estimates of internal cloud circulation patterns in the precipitation scavenging research. The information is applied to study incorporation of pollutants into such clouds at various locations relative to the cloud. Various environmental profiles of pollutant concentration are assumed in order to include the possible range of natural occurrences. The redistribution of such pollutants by the cloud air motions with no interaction considered among pollutant, rain, and cloudwater is investigated. The interaction of pollutant and rainwater and the resulting distribution of pollutant concentrations in the atmosphere and in the fallen rainwater are studied. The inclusion of pollutant in the cloudwater as condensation nuclei is considered. The model used to calculate air motions and other cloud properties is a two-dimensional time-dependent squall line thunderstorm model. The model variables are the two components of air motion in the plane of propagation of the storm, the air temperature, and the mixing ratios of water vapor, cloudwater, and rainwater. (MCW)

15830 (BNWL-tr-133) DIRECT DETERMINATION OF "EVAPOTRANSPIRATION" AND INFILTRATION BY MEANS OF MEASURING WATER CONTENT AND SUCTION (POTENTIAL). Royer, J. M.; Vachaud, G. Translated from Hydrol. Sci. Bull.; 19: No. 3, 319-333(1974). 29p. Dep. NTIS $4.50.

A local water balance is determined with the aid of measurements of changes in water content and water potential in the unsaturated zone of soil. For purposes of clarification first, the basic laws that state the flow physics in the unsaturated zone are briefly discussed; thereafter some technical aspects of the field measurement of water content and water potential are presented. Finally these techniques are illustrated by an example of the local water balance determined for a basin with data taken over ten months. (auth)

15831 (CONF-741216-1) REGIONAL ENVIRONMENTAL ANALYSIS AND MANAGEMENT: NEW TECHNOLOGIES FOR CURRENT PROBLEMS. Honea, R. B.; Paludan, C. T. N. (Oak Ridge National Lab., Tenn. (USA); National Aeronautics and Space Administration, Huntsville, Ala. (USA). George C. Marshall Space Flight Center). 1974. 10p. Dep. NTIS $4.00.

From international geographical union regional conference; Palmerston North, New Zealand (4 Dec 1974).

Advances in data acquisition and processing procedures for regional environmental analysis are discussed. Automated and semi-automated techniques employing Earth Resources Technology Satellite data and conventional data sources are presented. Experiences are summarized. The ERTS Computer Compatible Tapes provide a very complete and flexible record of Earth resources data and represent a viable medium to enhance regional environmental analysis research. Most ERTS research has focused on data acquisition potential of the system rather than how ERTS data may be incorporated into existing information systems for environmental analysis and management. Most research directed toward the design of automated and semi-automated spatial data acquisition systems has ignored the importance of referencing the data to an Earth grid. One of the greatest needs in regional environmental analysis and management is a quick and reliable means to acquire and process large volumes of spatial data. (MCW)

15832 (EUR-5217d) METEOROLOGICAL TRACERS IN REGIONAL PLANNING. Mueller, K. H. (Commission of the European Communities, Ispra (Italy). Joint Nuclear Research Center). 1974. 33p. (In German). Dep. NTIS (US Sales Only) $4.75. EUR BF 50.-.

Atmospheric tracers can be used as indicators to study both the ventilation of an urban region and its dispersion meteorology for air pollutants. A correlation analysis applied to the space-time dependent tracer concentrations is able to give transfer functions, the structure and characteristic parameters of which describe the meteorological and topographical situation of the urban region and its surroundings in an integral manner. An automatic air sampling system was developed. (tr-auth)

15833 (ORNL-NSF-EP-78) SYNTHETIC MEASURES OF TRUCK OPERATING TIMES BETWEEN THE METROPOLITAN CENTERS OF BEA ECONOMIC AREAS: 1950, 1960, AND 1970, WITH PROJECTIONS FOR 1980. Olsen, R. J.; Westley, G. W. (Oak Ridge National Lab., Tenn. (USA)). Jan 1975. Contract W-7405-eng-26. 71p. Dep. NTIS $6.75.

The synthetic measures of truck operating times between the metropolitan centers of BEA economic areas were prepared as part of a statistical analysis of industrial location. A measurement process that emphasizes the time of truck transport and standardizes regional differences in terrain and changing conditions of truck speed, roadways, and congestion is developed. The possibility that the gradual completion of the interstate highway system may have had a substantial and differential regional impact upon market accessibility was considered. A synthetic measurement was developed so as to use projected changes in road conditions to measure the impact of new highways on transport times. The measurement process used and the assumptions made and a few applications of the results, as well as a tabulation of synthetically measured truck operating times between over 700 city pairs for 1950, 1960, and 1970, with projections for 1980, are discussed. BEA economic areas are mutually exclusive functional economic areas that include the total land area and population of the United States. They were defined by the Office of Business Economics (now the Bureau of Economic Analysis) of the U. S. Department of Commerce in 1969 and are finding increased use as a geographic grid for regional economic analysis. (auth)

15834 (ORNL-NSF-EP-79) 1972 COUNTY AND CITY DATA BOOK: CUMULATIONS TO BEA AREAS. Olsen, R. J.; Bray, L. G.; Westley, G. W. (Oak Ridge National Lab., Tenn. (USA)). Dec 1974. 99p. Dep. NTIS $8.00.

The economic and social data included in this report were compiled from county data available on a computer tape of the County and City Data Book, 1972 as part of a statistical analysis of industrial location by BEA areas. BEA economic areas are mutually exclusive functional economic areas that include the total land area and population of the United States. They were defined by the Office of Business Economics (now the Bureau of Economic Analysis) of the U. S. Department of Commerce in 1969 and are finding increasing use as a geographic grid for regional economic analysis. (auth)

15835 (ORNL-UR-119) EVALUATING SOCIAL SECURITY MEASURES OF MIGRATION: BASIC CONSIDERATIONS. Nelson, K. P. (Oak Ridge National Lab., Tenn. (USA)). Jan 1975. Contract W-7405-eng-26. 48p. Dep. NTIS $5.50.

The weaknesses of data from the Social Security Administration's Current Work History Sample (CWHS) for measuring migration are evaluated so that its many strengths can be better utilized. CWHS data are of interest both descriptively, for measuring migration currently with detail on migrant characteristics, and analytically, as a basic data source for studying the causes and consequences of migration. After considering the data's coverage and quality, it is concluded that undercoverage of the migration of young adults may be a major but correctable source of bias in CWHS estimates of migration and indicates how this hypothesis can be tested through detailed comparison with the 1970 Census of Population. (auth)

15836 (SAND-74-0324) K-SHELL FLUORESCENCE YIELD OF IONIZED ALUMINUM. McGuire, E. J. (Sandia Labs., Albuquerque, N. Mex. (USA)). Dec 1974. Contract AT(29-1)-789. 15p. Dep. NTIS $4.00.

Auger and radiative transition rates are calculated for multiplets formed by adding an s vacancy to a partially filled p shell. These expressions are used to calculate the fluorescence yield for multiplet terms in Al ions. The fluorescence yields can differ by an order of magnitude for different terms of a multiplet. However, in averaging over multiplet terms, it is found that the ion fluorescence yield varies by at most a factor of two from its value in neutral Al. (auth)

15837 (UCRL-76186) SYSTEM MODELING FOR RELIABILITY AND SAFETY EVALUATION IN CHEMICAL PROCESSES. Lambert, H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 Nov 1974. 35p. (CONF-741205-1). Dep. NTIS $4.75.

From 67th annual meeting of the American Institute of Chemical Engineers; Washington, District of Columbia, USA (1 Dec 1974).

A systematic approach in analyzing a system for safety and reliability is given. The principal methods for identifying hazards and problem areas in a system are inductive and deductive analyses. The methods used depend on the scope and extent of the analysis. The methods include (1) a gross preliminary hazards analysis, (2) a detailed inductive failure modes and effects analysis, and (3) a comprehensive deductive fault tree analysis. Applications of the methods in analyzing chemical processing systems are discussed. (auth)

Chemistry

15838 (BNL-tr-583) THEORETICAL CONFORMATIONAL ANALYSIS OF A GLUTATHIONE MOLECULE. Galaktionov, S. G.; Nikiforovich, G. V.; Sherman, S. A. 1971. Translation by S. J. Amoretty of pp 138-145 from Plastidnyi App. Zhiznedeyatel, 1971. 11p. Dep. NTIS $4.00.

A theoretical conformational analysis of a glutathione molecule is made by characterizing the glutamate radical by an autonomous three-dimensional potential function and by recognizing that the cysteine radical plays the central role in determining the relative orientation of the different parts of the glutathione molecule. The calculation is also based on the assumption that both carboxyl groups are totally ionized. Two stable structures, characterized by a large conformational mobility, were calculated and both calculated structures are illustrated. The calculations indicate that about one-tenth of all the molecules in the equilibrium state should have conformation II and therefore the relative transitions of structures I and II can occur fairly easily. (JSR)

Life Sciences

15839 (CONF-740912-3) ORIGIN AND STRUCTURE OF AMERICAN ARID-ZONE ECOSYSTEMS. The Producers: Interactions Between Environment, Form, and Function. Miller, P. C.; Mooney, H. A. (San Diego State Univ., Calif. (USA). Dept. of Biology; Stanford Univ., Calif. (USA). Dept. of Biological Sciences). 1974. 18p. Dep. NTIS $4.00.

From 1st international congress of ecology; The Hague, Netherlands (8 Sep 1974).

The Mediterranean scrub regions of California and Chile occur in a climate with winter rain and summer drought and mild winter temperatures and are comprised predominantly of evergreen sclerophyllous shrubs. Within these regions gradients occur in both countries; the coast is drier than the inland and has a higher frequency of drought deciduous shrubs. Minor climatic differences occur between countries; California is hotter in summer and cooler in winter than Chile. Minor vegetational differences occur; California tends to have a greater frequency of narrow, steeply inclined leaves than Chile. The evergreen form occurs where the carbon cost of maintaining leaves through periods of low photosynthesis is lower than the cost of producing new leaves. The deciduous form occurs where the carbon cost of maintaining leaves is higher than the cost of producing new leaves. The shrub form, which is associated with the utilization of deep soil water in the summer, places the photosynthetic tissue above the hot soil surface increasing photosynthesis and water use efficiency. The herb form, associated with the utilization of shallow soil water in the spring, places leaves near the soil surface when surface temperatures are moderate, increasing photosynthesis and water use efficiency at this time. The narrow, steeply inclined leaves of hot summer active shrubs increase photosynthesis and water use efficiency. Leaf width and inclination are less important in plants active in the spring and in cool summers and are more variable in these plants. Thus, the evolution of vegetation form and function in the Mediterranean climate in California and Chile has resulted in a yearly course of productive structure which coincides with a pattern for maximum production and maximum water use efficiency. (auth)

15840 (COO-1599-84) SODIUM: A FACTOR IN GROWTH OF BLUE-GREEN ALGAE. Ward, A. K. (Michigan State Univ., Hickory Corners (USA). W. K. Kellogg Biological Station). 1974. 49p. Dep. NTIS $5.50.

Thesis.

The response of heterocystous blue-green algae to varying concentrations of sodium was examined in axenic culture as well as in situ studies. Laboratory cultures of Anabaena cylindrica were treated with four concentrations of sodium and three concentrations of nitrate to determine the response in terms of rates of acetylene reduction, ^{14}C assimilation, excretion of organic carbon, concentration of chlorophyll a, particulate organic carbon, particulate organic nitrogen, and heterocyst and filament numbers. Cultures of Anabaena cylindrica with no Na^+ added suffered from decreased rates of acetylene reduction, ^{14}C assimilation, excretion of organic carbon as well as lower concentrations of chlorophyll a and particulate organic carbon compared to cultures supplied with 5, 10, and 50 mg Na^+ $liter^{-1}$. Sodium deficient cultures released a higher percentage of previously fixed carbon as organic carbon. No differences in any area measured were demonstrable among cultures grown with 5, 10, and 50 mg Na^+ $liter^{-1}$. Sodium enrichment of natural phytoplankton populations indicated increased photosynthetic carbon fixation with small additions of sodium (5 mg Na^+ $liter^{-1}$), whereas higher concentrations (50, 100, and 200 mg Na^+ $liter^{-1}$) elicited neither a stimulatory nor an inhibitory response. No increase in in situ acetylene reduction rates occurred with additions of sodium. (auth)

15841 (COO-3162-25) EXCITED STATES IN THE PHOTOCHEMISTRY OF BACTERIAL PHOTOSYNTHESIS. Clayton, R. K.; Parson, W. W. (Cornell Univ., Ithaca, N. Y. (USA)). 1974. Contract AT(11-1)-3162. 3p. (CONF-740946-3). Dep. NTIS $4.00.

From third international congress on photosynthesis; Rehovot, Israel (2 Sep 1974).

Preparations from Rhodop seudomonas spheroides were examined for light-induced phenomena during photosynthesis of chlorophyll. (CH)

15842 (COO-3278-29) DINOFLAGELLATE ACCUMULATIONS IN CHESAPEAKE BAY. Seliger, H. H.; Loftus, M. E.; Subba Rao, D. V. (Johns Hopkins Univ., Baltimore, Md. (USA)). [nd]. Contract AT(11-1)-3278. 37p. (CONF-741130-1). Dep. NTIS $5.00.

From international conference on toxic dinoflagellate blooms; Boston, Massachusetts, USA (4 Nov 1974).

In the tributary estuaries of the Chesapeake Bay and in the central bay proper between 80 to 90 percent of the phytoplankton primary productivity and production is carried out by nannoplankton less than 10 microns in linear dimension. Stabilities of the water column and turbidities are such that the well-mixed surface waters encompass the entire euphotic zone. Superimposed on this background which averages 10 to 20 micrograms per liter of extractable chlorophyll a is a seasonal procession of the larger, strongly phototactic dinoflagellates Prorocentrum minimum, Gymnodinium nelsoni, G. splendens and Katodinium rotundatum in the upper bay and in addition Ceratium furca in the lower bay. These dinoflagellates increase in concentration subsequent to an initial cycle of nannoplankton production and rotifer and tintinnid predation on the former. There appears to be a correlation between the conversion of dissolved inorganic nitrogen and phosphorus into organic forms and the appearance of these species of dinoflagellates. The strong positive phototaxis (which can overcome mixing forces) of these dinoflagellates gives rise to disproportionate surface and near-surface concentrations in the water column. This upward vector, also periodic with a diel frequency, can occasionally phase with the two layer tidal exchange in the estuary and produce a reduced down-bay horizontal displacement for the dinoflagellates relative to the nannoplankton. This reduction in flushing rate is in effect an accumulation mechanism. These accumulation mechanisms result in elongated surface patches ranging in area from tens of hectares to many hundreds of hectares. These surface patches have been observed to contain chlorophyll a concentrations higher than 1000 micrograms per liter. The strong relative absorption of blue light by accessory pigments and chlorophyll gives a brownish-red visible color to these patches. High bacterial concentrations have been associated with many of these patches. Since the bacteria possess no obvious accumulation mechanism it may be assumed that they are stimulated to rapid goowth within the dense dinoflagellate patches. It is possible therefore that fish kills in the Chesapeake Bay, which have been coincident with mahogany tides, are initiated by the bacteria within the patches. (CH)

15843 (COO-3521-94) EFFECT OF DIMETHYLSULFOXIDE AND DIMETHYLFORMAMIDE ON THE GROWTH AND MORPHOLOGY OF TUMOR CELLS. Borenfreund, E.; Steinglass, M.; Korngold, G.; Bendich, A. (Sloan-Kettering Inst. for Cancer Research, New York (USA)). 1973. 17p. Dep. NTIS $4.00.

Results are reported from studies on the effects of dimethylsulfoxide and dimethylformamide on the growth and morphology of tumor cells grown in culture media. (CH)

15844 (EDFB-IBP-74-5) GEOECOLOGY INFORMATION SYSTEM. Part I. Biogeographic Mapping of Species Ranges: Documentation of Input and Data Checking Procedure for Computer Storage and Retrieval of Information. Schreiber, R. K.; Stephenson, R. L.; Goff, F. G.; West, D. C.; Muse, G. (Oak Ridge National Lab., Tenn. (USA)). Dec 1974. 46p. Dep. NTIS $5.45.

Rationale is presented for the design and development of a regional scale data bank for biogeographical information. Counties are used as the basic cell for storage and retrieval of data. Application of the described procedure for manual digitization and coding of species range maps is made using tree species found in Little's Atlas of United States Trees. The computer program for storage and retrieval of this spatial data is documented. (auth)

15845 (EDFB-IBP-74-6) RBAD: RELATIVE BASAL AREA DETERMINATION. A FORTRAN Program to Determine Relative Basal Area by Species and Plot from IBP Standard Format Forest Service Plot Tapes. Goff, F. G. (Oak Ridge National Lab., Tenn. (USA)). Dec 1974. Contract W-7405-eng-26. 28p. Dep. NTIS $4.00.

Computer codes are presented that were used in mapping the geographical distribution of tree species in the Eastern deciduous forest biome using Forest Service plot tapes. A FORTRAN listing of the main program, RBAD, and subroutines is included. (CH)

15846 (ISS-L-74/3) HEALTH ASPECTS OF RADIO-FREQUENCY ELECTROMAGNETIC RADIATION. Grandolfo, M. (Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica). 3 Apr 1974. 32p. (In Italian). Dep. NTIS (U. S. Sales Only) $4.75.

Many of the electromagnetic nonionizing radiations at certain frequencies, power levels, and exposure durations can produce biological effects or injury depending on multiple physical and biological variables. The pathophysiology of exposure to microwaves and radio frequency radiation, and the protection guides established for these waves in many Countries and Organizations are reviewed. (auth)

15847 (ISS-P-73/11) ELECTRON MICROSCOPE OBSERVATIONS ON MITOTIC CHROMOSOMES OF HUMAN LEUKOCYTES AND HeLa CELLS PREPARED BY FREEZE-ETCHING. Violante, A.; Bellavia, E.; Rebessi, S. (Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica). 15 Oct 1973. 36p. (In Italian). Dep. NTIS (U. S. Sales Only) $5.00.

By freeze-etching technique chromosomes of human leukocytes established cell lines and of HeLa cells were observed. Some experimental results are reported. (auth)

15848 (ISS-T-73/14) CENTRAL AND LOCAL ADMINISTRATIVE FUNCTIONS IN THE FIELD OF WATER POLLUTION. Cortellessa, G. (Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica). 30 Dec 1973. 21p. (In Italian). (CONF-731228-1). Dep. NTIS (US Sales Only) $4.25.

From seminar on industrial pollution; Milan, Italy (17 Dec 1973).

Technical problems, field actions, cooperation among authorities, and new possible public structures are discussed in an effort to indicate how to solve current difficulties in Rome, Italy, in the water pollution field. (auth)

15849 (LBL-3214) VULNERABILITY OF ECOSYSTEMS DISTURBED BY MAN. Harte, J.; Levy, D. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Sep 1974. Contract W-7405-eng-48. 32p. (CONF-740912-2). Dep. NTIS $4.75.

From first international congress of ecology; The Hague, Netherlands (8 Sep 1974).

The Liapunov stability theory was applied to mathematical models of energy and nutrient flow in ecosystems. The domain of stability under non-infinitesimal perturbations is discussed and significant differences are pointed out between models with and without detritus-decomposer feedback loops. Possible practical implications in predicting the effects of human activities on the environment are suggested. (CH)

15850 (ORNL-tr-2870) MATHEMATICAL MODEL OF THE POPULATION OF NEUTRODIAPTOMUS ANGUSTILOBUS IN DAL'NEYE LAKE. Prikhod'ko, T. I. Translated from Zool. Zh.; 50: No. 12, 1785-1793(1971). 14p. Dep. NTIS $4.00.

A mathematical model of an unsteady population of zooplanktonic organisms was constructed for the population of Neutrodiaptomus in the Dal'nee Lake. In spite of a considerable simplification of interactions between the population and the environment (specimens are assumed to live at the same temperature at all developmental stages, inverse influence of the population on predators and electivity of feeding as a function of the presence of different food components are not taken into account), a good coincidence was obtained for the calculated dynamics of numbers in stages during the year with the actual one. The effect of changes in the food base and pressure of predators upon the population was studied. (auth)

15851 (TID-26690) INVOLVEMENT OF DNA REPLICATION AND REPAIR IN MUTAGENESIS OF HAEMOPHILUS INFLUENZAE INDUCED BY N-NITROSOCARBARYL. Beattie, K. L. (Tennessee Univ., Memphis (USA). Dept. of Physiology and Biophysics). Aug 1974. 122p. Dep. NTIS $9.25.

Thesis.

Results are reported on an investigation of the cellular processes involved in mutagenesis, using the bacterium Haemophilus influenzae treated with the alkylating agent N-nitrosocarbaryl (NC). (CH)

15852 (TID-26693) MECHANISM OF RECOMBINATION DURING HAEMOPHILUS INFLUENZAE TRANSFORMATION. LeClerc, J. E. (Tennessee Univ., Knoxville (USA)). Aug 1974. 90p. Dep. NTIS $7.50.

Thesis.

The purpose of this investigation was to determine if the DNA of competent Haemophilus influenzae cells has structural features that may promote recombination with donor DNA and to gain information on the mechanism of recombination during transformation. (CH)

15853 (TID-26705) EFFECT OF PUNISHMENT ON THE BLOOD PRESSURE OF RATS WITH A GENETIC SUSCEPTIBILITY TO EXPERIMENTAL HYPERTENSION. Friedman, R. (State Univ. of New York, Stony Brook (USA)). Oct 1974. 88p. Dep. NTIS $7.50.

Thesis.

Rats with a genetic susceptibility to experimental hypertension were exposed daily for 13 weeks to one of four experimental conditions in order to determine the effects on blood pressure. Subjects in the Punishment group were required to press a lever in order to obtain food pellets. However, lever pressing also resulted in the presentation of a brief electric shock. Rats in the Yoked Food & Shock group experienced the identical amount and pattern of food and shock presentation. However, neither event was contingent upon their responses. Subjects in the Yoked Shock group also experienced the identical amount and pattern of shock presentation as Punishment subjects. Subjects in the Yoked Food group received the same amount of food as Punishment subjects but were not shocked. A control group was maintained on ad lib food without shock presentation. The combined effect of chronic food deprivation and electric shock presentation, with or without control over these variables, was a consistent, often severe elevation in blood pressure. However, despite the genetic susceptibility of the subjects, the elevations were not maintained after the aversive conditions were removed. (auth)

Materials

15854 (BNL-19412) SPIN WAVES IN AN AMORPHOUS METALLIC FERROMAGNET. Axe, J: D.; Passell, L.; Tsuei, C. C. (Brookhaven National Lab., Upton, N. Y. (USA); IBM Watson Research Center, Yorktown Heights, N. Y. (USA)). 1974. 7p. (CONF-741202-11). Dep. NTIS $4.00.

From 20th annual conference on magnetism and magnetic materials; San Francisco, California, USA (3 Dec 1974).

Low angle inelastic neutron scattering experiments were carried out on the amorphous ferromagnet $Fe_{75}P_{15}C_{10}$ with a Curie temperature T_c = 597°K. At reduced temperatures, $t = T/T_c$, between 0.5 and 0.83 well-defined spin waves were observed with propagation vectors $|q| = 2\pi/\lambda < 0.18\ A^{-1}$ with a ferromagnetic dispersion relation $\hbar\omega = D(T)q^2 + E(T)q^4$. Inability to close the scattering triangle rather than intrinsic broadening prevents extension of the measurements to even shorter wavelengths. At room temperature D = 149.5(±3)meV-A^2 and E = 680(±200) meV-A^4. (auth)

15855 (CONF-731094-1) RAMAN SPECTROSCOPY OF POLYETHYLENE AND POLYTETRAFLUOROETHYLENE AT HIGH PRESSURES. Nicol, M. (California Univ., Los Angeles (USA). Dept. of Chemistry). 1973. Contract AT(04-3)-34. 18p. Dep. NTIS $4.00.

From symposium on scattering spectroscopy; Rochester, New York, USA (11 Oct 1973).

Development of devices for optical spectroscopy of solids under pressures to 50 kbar at temperatures from 1.2 to 1000°K is described, and studies of the high-pressure properties of two polymer systems are briefly reviewed. Two types of devices are discussed: a 50-kbar piston-cylinder apparatus that is used from 77 to 500°K and a diamond-anvil apparatus that can be used from liquid helium to very high temperatures. Raman spectra of crystalline polyethylene and the n-alkanes, $n\text{-}C_{23}H_{48}$ and $n\text{-}C_{44}H_{90}$, were obtained with these devices. The assignment and interpretation of the pressure dependence of the low-frequency lattice-mode spectra in terms of model calculations are reported, and Fermi-resonance phenomena involving internal modes are described. The Raman spectrum of the high-pressure phase (III) of polytetrafluoroethylene is described, and results of an investigation of the pressure and temperature dependences of the kinetics of the PTFE II-III transition are summarized. (auth)

15856 (CONF-741202-12) MOESSBAUER STUDIES OF DILUTE Ag : Fe AND Ag : Co ALLOYS. Thompson, J. R.; Thomson, J. O. (Tennessee Univ., Knoxville (USA). Dept. of Physics; Oak Ridge National Lab., Tenn. (USA)). 1974. 6p. Dep. NTIS $4.00.

From 20th annual conference on magnetism and magnetic materials; San Francisco, California, USA (3 Dec 1974).

The dilute Kondo alloys Ag-^{57}Fe and Ag-^{57}Co were studied via the Moessbauer effect at temperatures between 0.022 and 20K and in applied magnetic fields from 0 to 60 kG. This allows study of both the thermal and magnetic breakup of the non-magnetic ground state. The higher temperature results are consistent with experimental results. As the temperature is lowered, a strong reduction from free spin behavior of the local moment is observed. At the lowest temperatures the dependence of the Fe hyperfine field, H_n^{57}, on applied field is compared with several theoretical and semiempirical expressions, where each describes the data moderately well, none with marked superi-

ority. Also reported are the first measurements of the hyperfine field of ^{57}Co in Ag, obtained via the intensity asymmetry of the spectra. The field can be described in terms of a large positive Knight shift $K = (28 \pm 8)\%$. The small magnitudes of the hyperfine fields result from the negative core polarization fields being offset by positive orbital fields and illustrate the importance of orbital effects. (auth)

15857 (COO-2390-5) REVIEW OF DIFFUSIONAL CREEP OF Al_2O_3. Cannon, R. M.; Coble, R. L. (Massachusetts Inst. of Tech., Cambridge (USA)). 1974. 40p. (CONF-740724-4). Dep. NTIS $5.00.

From symposium on plastic deformation of ceramics; University Park, Pennsylvania, USA (Jul 1974).

The diffusional creep mechanisms are reviewed including the extensions of the theories for application to ceramic materials. The creep data for Al_2O_3 are critically analyzed to show the relative conditions where normal and dislocation controlled diffusional creep are important. The behavior at intermediate stresses, when both slip and diffusional creep occur, is also discussed. (auth)

15858 (FRNC-TH-503) SECONDARY ION EMISSION FROM METALS. Hennequin, J. F. (Paris-11 Univ., 91 - Orsay (France)). 1968. 126p. (In French). Dep. NTIS (US Sales Only) $9.25.

Thesis.

The results of an experimental study on the secondary emission of ions and electrons from metals are reported. A determination of the energy and angular distributions of the secondary ionic emission revealed the kinetic nature of the emission, the observation of Auger electrons among the secondary electrons pointing to an ionization process. The true kinetic emission of the bare metal is obtained when the residual gas pressure in the apparatus is low enough for the emission of characteristic ions to become independent of the nature and pressure of this gas. The ionic emission (kinetic and chemical) is not directly connected with the focussed collision chains responsible for the emission of neutral atoms. Fast ions are formed from particles displaced at random in the target. Ionization results from the post-collision creation of a vacancy on a bound electronic level of a moving particle. When de-excitation takes place an electron is ejected at an energy characteristic of the metal. Electrons emitted by de-excitation inside the target are slowed down before their escape and contribute to the kinetic emission of secondary electrons; in the case of light metals however a de-excitation fraction takes place near the surface, the expelled electron then keeping its initial energy. Slow ions are also subject to an ionization mechanism of "thermal" origin, especially effective in the case of metals which, like aluminium, have a fairly low ionization energy. From these conclusions can be built a kinetic secondary ion emission theory. (auth)

15859 (INIS-MF-1252) EPR STUDY IN SINGLE CRYSTALS OF MgO ENRICHED WITH OXYGEN-17. Schoenberg, A. (Water Planning for Israel Ltd. (TAHAL), Tel Aviv). Aug 1973. 93p. INIS.

Thesis.

A method for growing single crystals of ^{17}O-enriched MgO was developed to investigate the oxygen-17 hyperfine structure of paramagnetic centers in the crystals. The crystal growing method and a brief account of the EPR experimental technique is described in Chapter 2. The results are presented in three succeeding chapters: (1) the hyperfine structure of the V_F center in MgO; (2) the superhyperfine structure of some transition metal ions in MgO; and (3) the dynamic Jahn-Teller effect of Ni^{1+} and Ni^{3+} ions in MgO. (auth)

15860 (INT-34/PS) TABLES OF MAGNETIC PROPERTIES. I. Cubic Systems. Cofta, H.; Kurzynski, M.; Micnas, R. (Uniwersytet Adama Michiewicza, Poznan (Poland). Instytut Fizyki). Nov 1972. 77p. INIS.

The Tables of Magnetic Properties consist of two parts. The first one, presented in tabular form, gives the data taken directly from original papers. It contains the Curie or Néel temperature, the Weiss (or asymptotic or paramagnetic) temperature, the Curie constant, the saturation magnetization, the anisotropy constants, the exchange integrals, and other parameters. The second part comprises the temperature or magnetic field dependences of some magnitudes in the form of diagrams, copied from original literature and some review works. The work contains a complete bibliography of 42 cubic compounds that crystallize in the spinel structure, 110 figures, and about 600 literature references. (auth)

15861 (LA-UR-74-1737) INFLUENCE OF METALS ON THE THERMAL DECOMPOSITION OF S-TRIAMINOTRINITROBENZENE (TATB). Loughran, E. D.; Wewerka, E. M.; Rogers, R. N.; Berlin, J. K. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 5p. (CONF-741204-3). Dep. NTIS $4.00.

From conference on compatibility of energetic materials with plastics and additives; Dover, New Jersey, USA (3 Dec 1974).

Although s-triaminotrinitrobenzene (TATB) possesses unusually high thermal stability for an organic explosive, the rate of gas evolution at elevated temperatures appears to be increased markedly by the presence of copper, iron, or brass. Aluminum in the same experimental environment produces little or no effect on the gas evolution rate. This paper presents the results of various experiments in which attempts were made to evaluate the magnitude of the effects and to elucidate the mechanism of the thermal degradation of TATB both in the pure state and in the presence of the aforementioned metals. (auth)

15862 (ORNL-tr-2887) CORROSION OF SILVER IN MOLTEN AgCl-LiCl·KCl: EFFECT OF A THERMAL GRADIENT. Chauvin, G.; Coriou, H.; Jarny, P. Translated by Martha Gerrard from Corros. Sci.; 10: 91-97(1970). 8p. Dep. NTIS $4.00.

The corrosion of Ag has been studied in molten AgCl–LiCl·KCl (eutectic) medium, under both isothermal and non-isothermal conditions ($t = 500°C$; $\Delta t = 70°C$). The results show that under isothermal conditions, corrosion is comparatively low. Under non-isothermal conditions, i.e. in the presence of a thermal gradient (specimens half immersed in molten salts), corrosion is rather severe owing to mass transfer, i.e. dissolution of Ag in the hot zone (bulk of the bath) and deposition of Ag in the cold zone (level of the bath). This phenomenon is essentially caused by a thermocell mechanism. (auth)

15863 (RFP-Trans-164) SEMI-EMPIRICAL DETERMINATION OF THE BORN-MAYER CONSTANTS OF CUBIC, FACE-CENTERED METALS, ESPECIALLY OF COPPER. Mann, E.; Seeger, A. Translated from J. Phys. Chem. Solids; 12: 314-325 (1960). 16p. Dep. NTIS $4.00.

The non-electrostatic interaction between the closed shells of the ion cores in the noble metals is usually described by a Born-Mayer energy per ion-pair of the form $\phi(r) = A \exp[-B(r/r_0 - 1)]$, where r denotes the separation between the neighboring atoms and r_0 the equilibrium separation. In the present paper the parameters A and B in the Born-Mayer relation are determined semi-empirically by the following methods: (a) From the ordinary (linear) elastic shear constants (following Huntington and Sietz); (b) from the pressure dependence of the shear moduli; (c) from the bulk modulus, utilizing a theoretical expression for the energy of the ground state, which accounts, within a few percent, for the energy of cohesion of copper; (d) from the (non-linear) volume-pressure relation as recently determined in shock wave experiments. Different methods give widely different pairs A, B. There exists, however, an approximate relationship between A and B. The results may be applied to interstitial atoms. (auth)

15864 (SAND-74-0290) ALTERNATE EXPLOSIVE TRAIN SYSTEMS FOR DRIVER SUBASSEMBLY. Final Report. Slape, R. J. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. (USA)). Jul 1973. Contract DA-11-173-AMC-487(A). 18p. (MHSMP-73-14). Dep. NTIS $4.00.

For Sandia Lab., Albuquerque, NM.

Three separate explosive systems to be considered as alternatives to the LX-13/Tetryl explosive system presently employed in driver subassemblies were considered. These alternate systems were as follows: replace only the Tetryl output pellet with a PETN pellet of such a density as to provide an output pressure, as measured by a PXD device, equivalent to that produced by Tetryl within ±1 kbar; replace only the Tetryl output pellet with an RDX/binder pellet with a binder content of 10–20% by weight and adjust the density of the selected formulation to again provide an output pressure equivalent to Tetryl within ±1 kbar; and replace the entire LX-13/Tetryl explosive system with an RDX/Sylgard extrudable containing 10–20% by weight Sylgard and still provide an output pressure equivalent to Tetryl within ±1 kbar. (auth)

15865 (SAND-74-0293) RDX/SYLGARD INVESTIGATION. Period Covered: April–June 1973. Faubion, B. D. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. (USA)). 1973. Contract DA-11-173-AMC-487(A). 18p. (MHSMP-73-35). Dep. NTIS $4.00.

For Sandia Labs., Albuquerque, NM.

Characterization of RDX for the purpose of developing product specifications and optimization for use in the RDX/Sylgard system has been carried out. The compatibility of RDX with HNAB, aluminum, and Sylgard was investigated using DTA, CRT, and Henkin's Test. None of these tests show any chemical incompatibility of the materials with each other. The formation of a low melting component (mp. 178 C) in the RDX/HNAB mixture was not considered as a serious incompatibility since the other test showed no significant change in the chemical stability of the mixture. Several methods for the quantitative analysis of the RDX/Sylgard mixture and analysis of trace amounts of HMX were evaluated. Differential pulsed polarography has the greatest potential as an inexpensive quality control method. The effect of surface area of the RDX on

the extrudability and detonation performance of the RDX/Sylgard system was investigated. (auth)

15866 (SAND-74-5823) EFFECT OF RESIN PROPERTIES ON THE TRANSVERSE MECHANICAL BEHAVIOR OF HIGH-PERFORMANCE COMPOSITES. Allred, R. E.; Gerstle, F. P. Jr. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 23p. (CONF-750201-1). Dep. NTIS $4.25.

From 30th anniversary reinforced plastics tech. management conference; Washington, District of Columbia, USA (5 Feb 1975).

The transverse mechanical properties of several high-performance composites were determined by axial tension tests on circumferentially wound thin-walled cylinders. Thornel 400, Thornel 75S and Kevlar filaments were combined with ERLA 4617, ERL 0510 and DER 332 epoxide resins to provide a wide range of constituent stiffnesses and strengths. Results indicate that composite transverse stiffness is three times more sensitive to changes in resin stiffness than to changes in filament transverse stiffness. Five micromechanics theories for predicting transverse modulus were compared: models incorporating matrix restraint gave the best agreement with experimental results. The excellent agreement shown by the theories of Halpin-Tsai and Greszczuk obviates more rigorous analyses for describing this class of materials. It was also concluded that the thin-walled specimen used to determine transverse stiffness was inadequate for characterization of transverse strength. (auth)

15867 (SU-326P17-X6) STRUCTURE DEPENDENCE OF HIGH TEMPERATURE DEFORMATION OF METALS. Progress Report, December 1, 1973-December 1, 1974. Nix, W. D.; Barrett, C. R. (Stanford Univ., Calif. (USA). Dept. of Materials Science and Engineering). 1 Jan 1975. Contract AT(04-3)-326. 59p. Dep. NTIS $6.00.

The research program is concerned with the structure dependence of high temperature deformation of metals and alloys. Work was completed on the structure and properties of Cr produced by physical vapor deposition. A technique was developed for producing refractory metal deposits with very fine grain sizes, as 3000 Å in the case of Cr. It is hoped that such fine grained metals would have superior resistance to embrittlement and swelling in irradiation environments due to the high density of grain boundaries. The impurity effects in Cr appear to mask the effects of grain size, at least as regards brittleness, so that ductile Cr in irradiation environments is not feasible at the present time. A way was found to solve the problem of wedge crack growth along grain boundaries in the presence of cavities or gas filled bubbles. This theory leads to a creep rupture equation that is based on an approximate analysis of hole growth by creep. The analysis does not include the very important hole-hole interactions. The results indicate that net hole growth in simple tension occurs only through the effects of hole-hole interactions. Work is continuing on the influence of precipitate free zones on the creep ductility of a precipitation strengthening Al alloy. By controlling the precipitate structure within the interior of the grains, it is shown that precipitate free zones have no effect on the creep properties. The effects of H_2O bubbles on the high temperature mechanical properties of Ag were studied. These bubbles, hopefully, will permit a simulation of the effects of He and other insoluble gases on the high temperature mechanical properties of structural metals. (MCW)

Physics and Engineering

15868 (AERE-TP-450) SOLUTION OF LARGE SPARSE UNSYMMETRIC SYSTEMS OF LINEAR EQUATION. Curtis, A. R.; Reid, J. K. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Jun 1971. 16p. Dep. NTIS (US Sales Only) $4.00.

An algorithm for the solution of a general sparse set of linear equations is described in moderate detail. It aims to maintain both stability and sparseness, and allows further systems with the same matrix, or another matrix having the same sparsity pattern, to be solved economically. It is compared, in tests on several nontrivial problems, with two earlier algorithms from which it was derived, and appears to combine the best features of both. (auth)

15869 (ARH-2195(Rev.)) SAFETY CONSIDERATIONS FOR USE OF HIGH-PRESSURE VESSELS. Kupfer, M. J.; Herbolsheimer, J. A. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). 10 Nov 1971. Contract AT(45-1)-2130. 13p. Dep. NTIS $4.00.

Three types of pressure vessels are described that are used for growing crystals of various silicates and for silicate solubility studies. The studies involve growing pollucite crystals from a thick gel of silicic acid, aluminum hydroxide, and cesium hydroxide. The procedures are described and the protective barricades for the vessels are given. Precautions for their safe usage are listed. (MCW)

15870 (ARH-SA-199) CAMAC SERIAL HIGHWAY UTILIZING A LASER LINK. Scalef, C. C. III; Troyer, G. L. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). 1974. Contract AT(45-1)-2130. 4p. (CONF-741213-4). Dep. NTIS $4.00.

From Nuclear Science Symposium; Washington, District of Columbia, USA (11 Dec 1974).

A system for extending a CAMAC serial highway to a distance of 2 kilometers using an optical link is described. The system utilizes commercially available laser transceivers operating in the pulse mode. Information is transmitted asynchronously and then resynchronized at the receiver interface. The serial highway extension provides effective remote instrument control and interprocessor communication for routine laboratory analyses and process support. (auth)

15871 (BNL-19404) LOW P. F. WATTMETER, IH-744: INSTRUCTIONS FOR USE. Chase, R. L. (Brookhaven National Lab., Upton, N. Y. (USA)). [nd]. 7p. Dep. NTIS $4.00.

The wattmeter consists of a four-quadrant multiplier, a selectable gain voltage amplifier, and an amplifier-integrator combination for converting an inductive pickup signal to a signal proportional to current. It is intended for measuring power (the average value of the instantaneous product of V and I) under conditions where the V and I signals are almost 90° out of phase. Under these circumstances, slight relative phase shifts in the two signals and small zero errors in wattmeter can cause serious errors. A systematic adjustment procedure for minimizing these errors is described. (auth)

15872 (CEA-R-4586) IMPROVEMENTS IN INVESTIGATION METHODS BY X-RAY TOPOGRAPHY. APPLICATIONS TO STUDIES OF SEMICONDUCTOR TECHNOLOGY PROBLEMS. Rolland, G. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Lab. d'Electronique et de Technologie de l'Informatique). Oct 1974. 89p. (In French). Dep. NTIS (US Sales Only) $7.50.

Thesis. Submitted to Universite Scientifique et Medicale de Grenoble (France).

The electrical performance of semiconductor electronic devices is liable to depend on the structural faults that exist in the starting material, or which are introduced into it by electronic devices fabrication technology. The present work shows some applications of x-ray topography to elucidate these structural defects in silicon. The examination method by x-ray topography is briefly discussed and the experimental set-up described. Results are presented in an analysis of the different types of faults created in silicon during integrated circuits fabrication steps: faults due to material growth, faults due to diffusions and thermal treatments. It will be shown that x-ray topography alone often is not sufficient to give a clear picture of formation and development of several types of faults, but must be assisted by other methods of characterization (chemical revelation, electron transmission microscopy). Finally the advantages of a double crystal diffraction method will be discussed. An apparatus using this method is presently being set up in the laboratory to complete classical x-ray topography. (tr-auth)

15873 (CEA-R-4587) CONTRIBUTION TO THE STUDY OF EPITAXIAL SILICON FILM ON SAPPHIRE AND ACTIVE DEVICES REALIZATION. Garcia, M. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). Oct 1974. 90p. (In French). Dep. NTIS (US Sales Only) $7.50.

Thesis. Submitted to Universite Scientifique et Medicale de Grenoble (France).

The problem is treated considering three aspects. It is concluded from the physical analysis of the silicon epitaxial film study that high Al concentration (10^{19} at cm^{-3}) is near the silicon–sapphire interface and near free silicon surface. Resistivity measurements imply that these impurities are in an inactive form and it is suggested that an Al_xO_y complex is present. From the technological aspect, a technological process was proposed to fabricate T MOS, N, or P channel, on silicon on sapphire films. The $Si-SiO_2$ interface quality is seen to be as good on SOS as on bulk wafers. The mobility in the channel of T MOS are similar on SOS and on bulk silicon. An electrical analysis of the silicon film was studied from the measurement of minority carriers recombination rate at Si–sapphire interface on N–type silicon and show the leakage currents of P^+/N diodes are due to recombination at this interface. Diffusion length of minority carriers in N–type film was measured. Values as high as 6 to 7 μ were found. (auth)

15874 (FEI-416) EXCITED ATOM DIFFUSION IN THE LOW-VOLTAGE ARC. Cherkovets, V. E. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1973. 21p. (In Russian). INIS.

The distribution of excited atoms in the interelectrode space of a low-voltage arc is studied. The energies taken out by the excited atoms at the cathode are determined. (tr-auth)

15875 (IFA-SR-10-1974) "ANDA" PROGRAM FOR MOESSBAUER SPECTRA IN TRANSMISSION EXPERIMENTS. Barb, D.;

Constantinescu, S.; Lazar, D. P. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 13p. Dep. NTIS (US Sales Only) $4.00.

A program for simulation of Moessbauer spectra in transmission experiments is reported. The program can be used for any combination of magnetic dipole and electric quadrupole interaction, taking into account Lorentzian shape of the gamma lines. (auth)

15876 (JINR-P4-8209) SPIN DIFFUSION OF THE NUCLEAR MAGNETIC MOMENT IN DILUTE ALLOYS. Pawlikowski, A.; Buchbinder, I. L.; Kuzemskii, A. L. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 21p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

A successive microscopic description of the nuclear magnetic relaxation in dilute alloys is developed. It is shown, that due to the dipolar interaction between host nuclear spins and impurity spins, a nonuniform distribution in the host nuclear spin system will occur and consequently the macroscopic relaxation time will be strongly determined by the spin diffusion. The expressions for the relaxation time in certain cases are given. (tr-auth)

15877 (LA-4221-MS) HEAT PIPE DESIGN CONSIDERATIONS. Kemme, J. E. (Los Alamos Scientific Lab., N. Mex. (USA)). 1 Aug 1969. Contract W-7405-eng-36. 7p. Dep. NTIS $4.00.

A review of heat pipe operation and limitations is presented. Although a heat pipe behaves like a structure of very high thermal conductance, it possesses heat transfer limitations which are governed by certain principles of fluid mechanics. These limitations, i.e., sonic, entrainment, wicking, and boiling are discussed. (RCK)

15878 (LA-5756-MS) PORTABLE FLASH X-RAY SYSTEMS: TECHNIQUES AND APPLICATIONS. Bryant, L. E. Jr. (Los Alamos Scientific Lab., N. Mex. (USA)). Sep 1974. Contract W-7405-eng-36. 16p. Dep. NTIS $4.00.

Advantages, limitations, applications, and techniques are given for 180-kV, 600-kV, and 2.0-MeV portable flash x-ray systems. Suggestions are made for protection of equipment and film, for accurate pulse-triggering, and for obtaining high-quality images under the constraints of blast and shrapnel from explosions. There are flash radiographs illustrating bullet and projectile trajectories, jet phenomena, demolition device and fragmentation device studies, and shock waves in solids. (auth)

15879 (LA-5790-PR) ELECTRONIC IDENTIFICATION AND TEMPERATURE MONITORING. Annual Report, July 1, 1973–June 30 1974. Koelle, A.; Freyman, R.; Depp, S.; Holm, D. (Los Alamos Scientific Lab., N. Mex. (USA)). Dec 1974. Contract W-7405-eng-36. 6p. Dep. NTIS $4.00.

During fiscal year 1975 the proof of principle of electronic identification and temperature monitoring of animals was established. A preprototype system including two transponders and battery powered readout was constructed and demonstrated to be capable of transmitting three decimal digits of identification and temperature to $\frac{1}{10}$ degree Celsius (C) accuracy to a range of about 7 m (20 ft). Plans are being made to improve the circuitry and to design a national electronic identification and temperature monitoring system with the United States Department of Agriculture (USDA). The system appears to have other applications for identifying and monitoring highly valued items. (auth)

15880 (LA-UR-74-1687) HIGH-SPEED OPTICAL ANALYSIS OF MICROSCOPIC PARTICLES. Crowell, J. M.; Salzman, G. C.; Mullaney, P. F.; Martin, J. C. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 16p. (CONF-741111-2). Dep. NTIS $4.00.

From Electro optics system design conference; San Francisco, California, USA (5 Nov 1974).

Information about size and internal structure of biological cells and other microscopic particles may be obtained from their optical properties. Plastic microspheres and human cells were passed singly through a flow chamber developed at LASL, scattered light was detected at thirty-two different angles, and multiparameter data were obtained using a photodiode array. Microspheres were classified according to size using a two-parameter pulse-height analyzer. With the incorporation of a second detector at 90°, the principal types of unstained and unfixed human white blood cells based on their light-scattering characteristics were classified. (MCW)

15881 (RD/B/N-3004) TECHNIQUE FOR THE MEASUREMENT OF GAS-LEAKAGE. Chivers, T. C.; Rogers, W. J.; Williams, M. E. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Jul 1974. 12p. Dep. NTIS (U. S. Sales Only) $4.00.

An apparatus for the measurement of gas leakage from in-service static seals is described. Means of achieving a simple secondary containment were developed that enable the leaking gas to be collected and pumped to the measuring equipment. The range of application covers a wide spectrum of leakage rates from very low loss rates that requires very sophisticated detection equipment, e.g. mass spectrometry, to conditions where standard gas meters can be used. Calibration of the system requires the determination of correction factors associated with the design, and results obtained suggest that errors should be less than 3%. (auth)

15882 (RT/ING-(74)31) REPEATABILITY OF VARIOUS TYPES OF THERMOCOUPLES EXPOSED TO THERMAL CYCLING. Lupoli, P.; Pandolfi, L. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Sep 1974. 44p. (In Italian). Dep. NTIS (US Sales Only) $5.25.

Thermoelectric stability of some thermocouples in the range 400 to 1000°C, after exposure to air at 1000°C for periods of time up to 1000 h, was studied. Couples prepared from Pt/0.1% Mo–Pt/5% Mo; Platinel II, Pt–Pt/10%.Rh; Au–Pd; Ag–Pd; chromel–alumel bare wires; and Pt–Pt/10% Rh; chromel–alumel sheated couples were considered. In the first case the thermal emf variation is generally not high and sometimes does not exceed the calibration error. Tables giving emfs for each degree Celsius were computed for some of them. In the other case the errors increase with time and may amount to 100°C or more, as for Pt–Pt/10% Rh, MgO insulated inconel sheated thermocouples. (tr-auth)

15883 (SAND-74-0031) COINCIDENT COORDINATE METHOD FOR INCREASED EFFICIENCIES IN ACHIEVING MATCH AND FIT OF PARTS. Conlon, T. P. (Sandia Labs., Albuquerque, N. Mex. (USA)). Jan 1975. Contract AT(29-1)-789. 14p. Dep. NTIS $4.00.

The coincident Coordinate Method (COCOM) was developed to eliminate inefficiencies and inconsistencies in the design definition, manufacture, and inspection of piece parts. An example computer program that illustrates the COCOM approach is presented, and applications of the method are reviewed. Steps for implementing this approach into a total production system are suggested. (auth)

15884 (SAND-74-0402) ROTATIONS AND INVARIANTS OF SECOND-ORDER TENSORS. Herrmann, W. (Sandia Labs., Albuquerque, N. Mex. (USA)). Dec 1974. Contract AT(29-1)-789. 83p. Dep. NTIS $7.25.

A number of results that are useful in connection with tensor calculations commonly encountered in continuum mechanics is presented. Specifically, some common properties of symmetric and orthogonal second-order tensors in three dimensions are collected in an elementary unified discussion for ready reference. FORTRAN subroutines are presented that perform most common vector and tensor calculations. (auth)

15885 (SAND-74-1070) DEVELOPMENT OF A TARGET AND CONSOLIDATED MEASUREMENT AND CONTROL DEVICE FOR USE IN HIGH TEMPERATURE SHOCK WAVE STUDIES. Baldwin, D. B. (Sandia Labs., Livermore, Calif. (USA)). Dec 1974. Contract AT(29-1)-789. 24p. Dep. NTIS $4.25.

The development of refined experimental techniques for high temperature shock wave studies is described. Described herein is the development of two target configurations that are suitable for shock wave experiments at high temperature. The development of a consolidated instrumentation package for systematic measurement and control of target temperature, as well as certain other modifications, is discussed. (auth)

15886 (SAND-74-5863) EVIDENCE OF OUTGASSED WATER VAPOR AS DETECTED BY AN ON-BOARD MASS SPECTROMETER. Woods, R. O. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 10p. (CONF-741203-2). Dep. NTIS $4.00.

From conference on the American Geophysical Union; San Francisco, California, USA (12 Dec 1974).

A cryogenically pumped positive-ion and neutral-species quadrupole mass spectrometer was flown as part of the instrument payload in a balloon-borne experiment at 28 kilometers altitude. The relevance of the outgassing problem and the relationship of the measured water vapor density to the results of other experiments in the payload are discussed. (auth)

15887 (SAND-74-8632) ACTIVE RC FILTER DESIGN USING COMPENSATED OPERATIONAL AMPLIFIERS. Soderstrand, M. A.; Szczupak, J. (Sandia Labs., Livermore, Calif. (USA)). Sep 1974. Contract AT(29-1)-789. 12p. (CONF-740484-1). Dep. NTIS $4.00.

From 17th mid-west symposium on circuits and systems; San Francisco, California, USA (21 Apr 1974).

A very simple active RC filter design procedure can take into account the non-ideal effects caused by the frequency compensation required for an operational amplifier. Through proper choice of topology, this design procedure can guarantee the realization of the important properties of the ideal filter structure while in-

creasing considerably the frequencies at which the structure is usable. The topology selection criteria are based on the circuit design using ideal operational amplifiers and thus the technique does not require a complicated non-ideal analysis of the circuit. Nevertheless, if the procedure is followed, the designer is assured of obtaining the most out of the gain-bandwidth of the actual operational amplifier chosen for use in the circuit. (auth)

15888 (SAND-74-8656) CASE HISTORY OF A JOINING BY PLATING APPLICATION. Dini, J. W.; Johnson, H. R. (Sandia Labs., Livermore, Calif. (USA)). Oct 1974. Contract AT(29-1)-789. 16p. (CONF-750203-1). Dep. NTIS $4.00.

From 11th airlines plating forum; San Francisco, California, USA (4 Feb 1975).

An application wherein large aluminum parts were joined to stainless steel parts by using electroplating is described. Mechanical, thermal, and corrosion tests used to prove the viability of the process are reviewed as are certification procedures used for finished parts. Spin-off from this work resulted in a joining technique for situations where conventional methods are inadequate. (auth)

15889 (SAND-74-8663) GENERAL NONLINEAR ANALYSIS OF TWO-DIMENSIONAL STRUCTURES: GNATS. Callabresi, M. L.; Young, R. C. (Sandia Labs., Livermore, Calif. (USA)). Nov 1974. Contract AT(29-1)-789. 7p. (CONF-741001-35). Dep. NTIS $4.00.

From CUBE symposium; Livermore, California, USA (23 Oct 1974).

GNATS is an incremental, large-displacement, large-strain elastic-plastic finite element computer program designed for the general nonlinear analysis of axisymmetric and two-dimensional static structures. A Lagrangian coordinate system is used for describing the equilibrium displaced configuration of the body. Material models provide for elastic-plastic material behavior with isotropic, kinematic or combined hardening. Two isoparametric finite elements are included in the program, the linear Q4 and the quadratic Q8. Several incremental solution algorithms are available and an equilibrium check is used at the end of each solution to insure that equilibrium is satisfied to a specified tolerance. Included in the GNATS system is a pre-processor I-J mesh generator and two postprocessor programs. The interactive graphics postprocessor program provides for plotting contours of stress and strain values, while the other postprocessor program allows the analyst to print selected data quantities appropriate for his specific problem. (auth)

15890 (SGAE-2345) COMPUTER-OPERATED PRINTED CIRCUIT LAYOUT. Kaltseis, J. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Physik-Inst.). Oct 1974. 28p. (In German). (PH-171/74). Dep. NTIS (U. S. Sales Only) $4.50.

A system for minicomputer-driven interactive printed circuit board layout generating is described. The system is especially useful for the user geared to low-volume production of many different types of boards of different size, electronics, and line density. The primary advantage of this system is that the layout is under the designer's continual supervision and control. The system is capable of displaying the current state of the layout after each modification; thus the designer becomes aware of errors as soon as they occur. The hardware consists of a PDP-11 minicomputer (any type), teleprinter, storage scope, 20-function keyboard, and an incremental plotter. (tr-auth)

15891 (SLA-74-0118) LIGHTNING PROTECTION PROVIDED BY THE LIGHTNING ARRESTOR CONNECTOR IN CONJUNCTION WITH DOWNSTREAM INDUCTANCE. Jackson, C. E. (Sandia Labs., Albuquerque, N. Mex. (USA)). Jan 1975. Contract AT(29-1)-789. 22p. Dep. NTIS $4.25.

This report describes and presents the results of an analysis performed to evaluate the feasibility of replacing the downstream switches currently used in conjunction with the Lightning Arrestor Connector (LAC) in weapon system applications with downstream inductance coils. (auth)

15892 (TID-26694) ELECTRON ATTACHMENT TO MOLECULES IN VERY HIGH PRESSURE GASES. Goans, R. E. (Tennessee Univ., Knoxville (USA)). Jun 1974. 130p. Dep. NTIS $9.50.

Thesis.

Electron capture mechanisms and reaction schemes were developed for electron attachment to O_2, C_6H_6, and C_2H_5Br embedded in high densities of N_2 ($P_{N_2} \leq 36$ atm), Ar ($P_{Ar} \leq 56$ atm), C_2H_4 ($Pc_{_2H_4} \leq 22$ atm), and C_2H_6 ($Pc_{_2H_6} \leq 23$ atm). As the density of each medium increases, each is found to affect the attachment rate in a different manner, indicating the profound effect and importance of the environment on the electron attachment process. The results of a study on the capture of slow (<1 eV) electrons by O_2 in high pressures of N_2, C_2H_4, and C_2H_6 media are presented and discussed, and a model is presented to account for the experimental observations in each case. Benzene was also found to capture slow electrons in high pressures of N_2 and Ar media, and a model is presented to account for the observed results. The finding that C_6H_6 capture electrons in the gas phase forces the conclusion that $(EA)_B > 0$ eV in contrast to the accepted view that $(EA)_B < 0$ eV. Bromoethane was found to capture slow (< 3 eV) electrons in high pressures of N_2 and Ar, and a reaction mechanism is presented which accounts for the relative magnitudes of the rate constants for autoionization, dissociation, and collisional stabilization. The high pressure data for electron attachment to O_2, C_6H_6, and C_2H_5 Br to form the respective negative ions were extrapolated to liquid densities to yield values of the attachment rate in the liquid state. These values generally are in reasonable agreement with those obtained by other investigators using liquid solutions. (auth)

15893 (TID-26695) REACTIONS OF METASTABLE MERCURY, $Hg6^3P_2^0$ AND $Hg6'^3D_3^0$, WITH CHLORINE AND CHLORINATED ALKANES. Johnson, S. G. (Tennessee Univ., Knoxville (USA)). Dec 1974. 150p. Dep. NTIS $10.50.

Thesis.

The reactions of the metastable $Hg6^3P_2^0$ with Cl_2, CCl_4, $CHCl_3$, CH_2Cl_2, CH_3Cl, 1,1,1-$C_2H_3Cl_3$, and 1,1,2-$C_2H_3Cl_3$ were investigated for the production of the excited electronic state of $B^2\Sigma^+$ of the HgCl molecule, and for the quenching process in which the resonant state $Hg6^3P_1^0$ was produced. The reactions of the metastable $Hg6'^3D_3^0$ with Cl_2, CH_3Cl, and CH_2Cl_2 were also investigated for the production of electronically excited states $B^2\Sigma^+$, $C^2\pi_{1/2}$, and $D^2\pi_{3/2}$ of the HgCl molecule. The experiments were performed using the crossed beam technique. The reactions were detected by radiative emission from the excited molecular states or from atomic resonant states. Radiation from the reactions was viewed by a monochromator photomultiplier detection system. The mercury atoms were excited to the metastable state by electron impact. (MCW)

15894 (UCRL-51700) INDUCED GROUND CURRENT FLOW PATTERNS FOR ELEVATED WIRE ANTENNAS. Miller, E. K.; Deadrick, F. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 7 Nov 1974. Contract W-7405-eng-48. 12p. Dep. NTIS $4.00.

This report presents a preliminary approach to the efficient design of antenna ground screens. Indications are that prior knowledge of the distribution pattern of the perfect-ground induced currents may permit more efficient specification of the ground screen geometry. A method of computing perfect ground plane surface currents, which are plotted to show both the direction and magnitude of induced ground current patterns is given and illustrated with several numerical examples. (auth)

15895 (UCRL-51702) HIGH-VOLTAGE PHOTOGRAPHY APPLIED TO MATERIALS SCIENCE. Lord, D. E.; Petrini, R. R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 25 Nov 1974. Contract W-7405-eng-48. 12p. Dep. NTIS $4.00.

Application of high-voltage photography to a variety of materials science uses, particularly residual strain measurement, is described. The technique appears to magnify an object's surface/subsurface condition that is an indicator of its internal strain state. High-voltage photography appears sensitive to impurities and porosities as well. Materials testing and nondestructive testing applications appear numerous. (auth)

15896 UCRL-75852) RECENT FOUR-D CALCULATIONS OF TIME DEPENDENT PROPAGATION PHENOMENA. Fleck, J. A. Jr.; Morris, J. R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Sep 1974. 41p. (CONF-741062-1). Dep. NTIS $5.25.

From 1st Department of Defense conference on high energy laser technology; San Diego, California, USA (1 Oct 1974).

Thermal blooming under conditions where wind patterns lead to steady state density distributions is well understood. A fully time dependent calculation is required in three regimes of interest, however. These are (1) CW propagation in the presence of stagnation or dead zones; (2) multipulse propagation; and (3) trans-sonic slewing. For wind Mach numbers close to 1 the time required to establish a steady state is $\sim a/(v_x - c_s)$, where a is the beam radius, v_x is the transverse wind speed, and c_s is the sound speed. This suggests that a steady state solution to the linearized hydrodynamic equations cannot exist. For any practical propagation application, however, the exact trans-sonic condition is not very important, since it applies over an exceedingly small portion of the total propagation path. For wind speeds differing from $M = 1$ by the order of 10^{-2}, say, the time required for a steady density distribution to set in is equivalent to that corresponding to a wind speed of a few meters per sec. Therefore propagation involving near

sonic slewing should be accurately analyzable in terms of steady state solutions to the linearized hydrodynamic equations, therefore, only applications 1 and 2 are treated. (auth)

15897 (VPI-E-74-29) EFFECTS OF ARTIFICIAL CRACKS AND POISSON'S RATIO UPON PHOTOELASTIC STRESS INTENSITY DETERMINATION. Jolles, M.; McGowan, J. J.; Smith, C. W. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Engineering Science and Mechanics). Nov 1974. 28p.

For National Science Foundation, Washington, DC.

A series of stress freezing photoelastic experiments were performed with multiple replications upon edge cracked strips for three types of cracks in current use: i) rectangular slots 0.152 mm wide, ii) 1.59 mm wide slots terminating in a 30° vee notch of approximately 0.025 mm root radius, and iii) natural cracks (approximately 0.0025 mm root radius). Stress intensity results were compared with the Gross-Srawley Analysis; in addition (i) was compared with Savin's solution. It was concluded that (ii) and (iii) yield the same results but (i) was slightly higher. Both (ii) and (iii) were about 12% higher than the Gross-Srawley results. This is conjectured to be related to a Poisson's Ratio Effect. (auth)

15898 (Y-DL-446) PENETRANT INSPECTION OF WELDS. Nicely, J. W. (Oak Ridge Y-12 Plant, Tenn. (USA)). Dec 1974. Contract W-7405-eng-26. 7p. (CONF-741224-1). Dep. NTIS $4.00.

From meeting on inspection of welds; Knoxville, Tennessee, USA (5 Dec 1974).

Liquid penetrant inspection was probably the earliest nondestructive technique applied in practice. It is unique in that it is almost entirely independent of the geometrical shape of the part to be tested. Penetrant inspection is a sensitive, relatively low cost method for detecting surface discontinuities, and can generally be used on any nonporous metallic or nonmetallic materials. It will reveal cracks of extreme tightness, and inspectors can inspect entire surface of complex shapes in one sequence of operations. (auth)

15899 CoRaD (COUNT RATE DISCRIMINATOR) (3 Oct 1973) (ENGINEERING MATERIALS). (California Univ., Livermore (USA). Lawrence Livermore Lab.). (CAPE-2400).

1 drawing.

The count rate discriminator, CoRaD, was developed for use with the x-ray microprobe and scanning electron microscope. It is a digital device that facilitates the production of background-free x-ray scanning images. It has been used to great advantage in analyzing multiphase specimens containing the same elements in different proportions. CoRaD permits the selective display of any one phase exclusive of the others. When CoRaD is interfaced to three scalers, the volume fraction and mean particle size of selected phases can be determined. (auth)

15900 MCS-8 CONTROL PROCESSOR (FEB 1974) (ENGINEERING MATERIALS). (California Univ., Livermore (USA). Lawrence Livermore Lab.). (CAPE-2402).

1 drawing.

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